THE
ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER
ESTABLISHED 1872

Volume CXXVI. No. 3244

Friday, January 26th, 1940

Contents

	Page
Editorial—Measuring Instruments	87
Meter Design. By O. Howarth, M.I.E.E.	89
Certification of Meters. By S. H. Richards, M.I.E.E.	92
New Sliding-rate Meter	95
Electrical Instruments. By G. F. Shotter, M.I.E.E.	96
Strain Clamps	100
Switchgear Maintenance. By R. T. Lythall, A.M.I.E.E.	101
Institution Proceedings	102
The Norwich Appointment	104
Personal	105
Correspondence	106
Parliamentary News	106
New Electrical Products	107
Commercial and Industrial	108
Electricity Supply	111
Local Authorities' Lighting Plans	112
New Patents	113
Financial Section	114
Contract Information	117

Classified Advertisements (Official Notices, Situations Vacant, etc.)	53
Index to Advertisers	76
Index to Advertisers' Products	80

EDITORIAL, ADVERTISING AND PUBLISHING OFFICES: Dorset House, Stamford Street, London, S.E.1

Telegraphic Address: "Ageekay, Sedist, London." Code, A.B.C. Telephone No.: Waterloo 3333 (50 lines)
Subscription Rates, Postage free: United Kingdom, £1 14s. 8d. Canada, £1 12s. 6d. Colonial and Foreign, £2 1s. 6d. per annum
Cheques and Postal Orders (on Chief Office, London) to be made payable to ELECTRICAL REVIEW, LTD., and crossed "Lloyds Bank"

The MAGICOAL Cure for Blackout Blues

There is nothing like a friendly Magicoal on the hearth to lessen the length of the longest face.

The cheering effect of a Magicoal Fire is almost traditional.

Tell your customers about Magicoal. Tell them why Magicoal is the ideal fire for the refuge room: no mains to turn off; no fear of explosion; no open chimneys required; no coal, ash or cleaning-up to bother with.

Regd. Design
H. H. Berry's
Patents (Home
and Abroad).

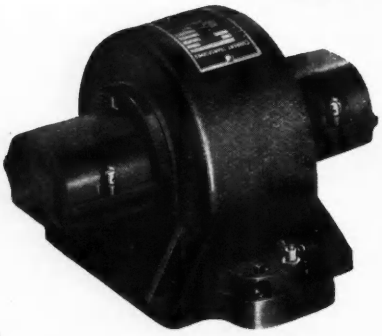
QUEENSBERRY

Berry's ELECTRIC LTD

TOUCHBUTTON HOUSE, 85-86, Newman Street, London, W.1
Telephone: Museum 6800 (9 lines).
Also: BIRMINGHAM, MANCHESTER & NEWCASTLE.
Sole Agents for Scotland: Wood & Cairns Ltd., Edinburgh, Glasgow & Dundee.

SANGAMO

CURRENT TRANSFORMERS



NEW!
Model S2

All insulated—All enclosed

- ALL INSULATED.
- ALL ENCLOSED.
- BSS ACCURACY.
- RING TYPE CORES.
- AUTOMATIC SHORT CIRCUITING DEVICE.
- SMALL SIZE. LIGHT WEIGHT.

An outstanding feature of the new Sangamo Weston Model S2 Current Transformers is that in addition to being all insulated, they are totally enclosed.

The transformers conform with B.S.S. No. 81, 1936, and can be supplied in class AM, BM or CM accuracies.

They have the ideal current transformer construction for mechanical strength and electrical performance, the windings being toroidally wound on ring type cores of high permeability low loss nickel iron alloy.

The moisture proof bakelite housing of the transformers eliminates the necessity for earthing and completely encloses the primary terminals. A combination terminal block and automatic short circuiting device is standard. The transformers are small, light in weight and neat in design.

A range of bakelite housed Model SI Transformers which are similar in design is also available.

Please write for full details.

SANGAMO WESTON LTD., ENFIELD, MIDDX., ENGLAND.
PHONE - ENFIELD 3434 (6 lines). GRAMS - "BRITISANGO" ENFIELD

THE
ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXVI. No. 3244 JANUARY 26, 1940 Price SIXPENCE

Measuring Instruments

The Last War and Now

THAT minute drop in the ocean of time represented by the twenty years interval between 1919 and 1939 contains within it a multitude of achievements in the scientific and engineering spheres. To many, moreover, who read these lines it will have encompassed a complete career, and the opening of a new decade forms a good opportunity for taking stock of the situation as it exists to-day.

There is little doubt that a large number of our modern advances had their genesis in the needs, both civil and military, of 1914-1918. Thus Sir Ambrose Fleming, lecturing in the I.E.E. theatre in 1926, gave it as his opinion that the amount of research poured into the development of wireless communications during the war period had placed broadcasting some ten years further ahead than would have been accomplished by any ordinary peacetime progress. The art of aviation and the engineering problems involved in the bulk transmission of power alike received a similar impetus.

Contribution to Mechanisation

" Mechanisation " is now so much a part of our daily life that, except in times of stress, it tends to pass unnoticed. Automatic control is an outstanding example and the extent to which electrical devices are employed for this purpose has assured for the electrical measuring industry a position of major importance in the life of the country.

The Institution of Electrical Engineers early showed its appreciation of this trend by forming, in 1928, a Meter and Instrument Section before which the special problems connected with electrical measurements can be discussed and this Technical Section has had for the past eleven years a series of particularly successful sessions. It has also been our custom to publish annually an issue in which the year's progress in the technique of electrical measurements is reviewed and the articles by Messrs. O. Howarth, S. H. Richards and G. F. Shotter in this issue, for example, summarise the present position fairly completely.

The steady growth of the exhibitions arranged by the Physical and Optical Societies, and the extent to which electrical measuring devices have tended to exceed in number all other classes of exhibit, are further tributes to the importance of this branch of electrical science. The cancellation, due to war conditions, of the exhibition this January is keenly felt by those to whom it is, from a professional standpoint, the event of the year.

It is satisfactory to note that, in contrast to the position in 1914, little or no reliance is now placed on foreign supplies either by instrument or meter manufacturers. For example, adequate quantities of magnets of the latest alloys, and of entirely English manufacture, have long since been available; again excellent quality copper wire, both silk and enamel covered, and resistance wire of nickel copper alloy are procurable in abundance. The special qualities required in resistance materials of the manganin copper group still present some difficulty, but a manufacturer who has already achieved prominence in the development of metallurgical products essential for the electrical industry is now engaged in the necessary research and there is little doubt that a satisfactory product will soon become available. Mention must also be made of the high state of perfection attained in the manufacture of nickel-iron alloys of high permeability, with the development of which this country has been so intimately connected.

Sapphire Bearings

The necessity of providing an adequate supply of sapphire jewel bearings for indicating instruments was anticipated by the formation of a B.S.I. Committee. This has since surveyed and simplified the whole problem and more than one factory " somewhere in England " is engaged in the mass production of sapphire bearings quite equal to the formerly widely esteemed foreign product. Thanks to the foresight of a prominent firm of electrical instrument manufacturers the supply of bronze hair springs has been amply provided for.

In every direction the material needs of the electrical measuring instrument industry are being adequately provided for and we may look forward to the future with confidence since whatever demands the coming struggle may make there exists, to a degree far exceeding that obtaining twenty years ago, a technical and industrial machine more than capable of maintaining both an adequate supply and that excellence of design and construction which has become an outstanding characteristic of British electrical measuring instruments.

Prices and the Consumer

THE Association of Non-Statutory Electricity Suppliers & Distributors states that its members have not yet increased their selling prices on account of increased costs, although authorised suppliers have raised their charges without consulting their consumers. This is very meritorious, if not commercially sound, but we cannot understand the reference to consultation with the consumers. If consumers are consulted they will almost automatically decline to approve any increase, however necessary it may be. And why should electricity consumers be singled out for consultation? Do the grocers, butchers, bakers, and other suppliers of daily necessities consult their customers before putting up their prices? We agree that public utilities should give a reasoned explanation of the necessity for higher prices, but that is about as far as they can go.

The Wider Outlook

WHETHER electrical engineers best serve their industry by concentrating their attention on purely electrical matters or by studying also economics and other extraneous subjects is an old question. It was raised anew by Mr. A. A. B. Martin before the I.E.E. Dundee Sub-Centre. He suggested that engineers ought not to confine themselves to the narrow limits of electrical engineering "even during their early years." The inclusion of the word "even" detracts from the force of the argument, as it is, surely, in the initial stages that over-specialisation is most to be avoided. Given the opportunity then to view the prospects from the widest angle, the young engineer will find out later whether his natural bent is more towards the purely technical or whether by temperament he is better suited to administrative work that nevertheless requires a broad engineering background. In our diverse industry, many stages come between these extremes and the choice is not limited to two clear-cut alternatives, there being scope for all kinds of ability. To work in water-tight compartments is, however, fundamentally wrong, and engineering institutions and the technical Press exist to enable engineers to view their particular work in relation to the whole.

United Effort

AN example of the engineer whose broad attainments have enabled him to take a prominent part in national affairs is Mr. Raoul Dautry, the French Minister of Armament. He was previously Director-in-Chief of the State Railways, which owe much of their recent progress to his technical knowledge and also to the understanding of workers of all grades that he acquired during his experience as an engineer. When Mr. Dautry expressed appreciation of the engineering work he had seen during his visit last week to his opposite number here, Dr. Leslie Burgin, Minister of Supply (who himself gained an insight into electricity supply problems while Minister of Transport), his words carried conviction as those of a man who knew exactly what he was talking about. No time was spent on "negotiations or exchanges of view" and, with the assistance of his technical staff headed by Dr. Paul Montel, he was able to get down immediately to very practical collaboration.

A Common Pool

COLLABORATION between Great Britain and France includes the pooling of all scientific and engineering resources—men, laboratories and workshops. From the immense "kitty" thus formed either country will draw what it wants (e.g., machine tools were mentioned) for use wherever it may be required. This arrangement is an extension of the principle under which the Central Electricity Board has accumulated reserve stocks of electrical plant to the value of £3 million for use in emergency in any part of this country. Similar plans have been drawn up by various regional bodies. For example, Mr. F. S. Naylor told the I.E.E. Sheffield Sub-Centre of the joint investigations made by the steel concerns in that locality into the total spare capacity of various types of electrical apparatus and the potentialities for repair work. Their object is to maintain the supply under all war conditions and also to reduce the heavy expenditure that would be incurred by separate action—about £35,000 could be saved in the provision of large transformers alone. Fortunately, many of the air-raid precautions in the electrical industry will have a peace-time value and have been designed with that in view.

Steam Conditions

THE paramount importance of maintaining breadth of view through contacts between various branches of engineering is, as Sir Leonard Pearce states in his Thomas Hawksley Lecture, one of the lessons to be derived from a survey of power station progress during the present century. Such a survey as he presents, with examples taken from all parts of the world, is of far more than mere historical interest. His data regarding developments, with many of which he has been intimately associated, and of the results achieved at different stages are closely reasoned from the practical standpoint and are supported by well-selected appendices relating to fundamental theory—the whole being a veritable textbook on the choice of steam conditions. Sir Leonard's preference is for boiler pressures not exceeding 1,500 lb. per sq. in. without reheating, and he looks forward to steam temperatures of 1,000 deg. F. and operating thermal efficiencies of 35 per cent. or so. He is, however, quite fair to other points of view, which are providing so healthy a competition in power station technique just now. There will, we believe, be no two opinions regarding his conclusion that but for the fuel economies brought about in the ways he discusses, advances in the price of coal would have inevitably increased the costs of production. These would ultimately have had to be borne by consumers.

Battery Applications

WHILE with large-scale AC generation the storage battery has been ousted from its early important position as load leveller and standby at power stations, there are still many functions, such as switch operation, that it regularly fulfils at central points. Nevertheless, so numerous are the purposes to which secondary cells can be applied, as Mr. E. C. McKinnon shows in his I.E.E. paper, that they ought eventually, one would suppose, to compensate for the 150,000 kW which has been taken out of central stations during the past fifteen years. Modern applications for batteries may be regarded under two heads—those that extend the use of electricity (e.g., transport) and those that promote continuity of supply for essential services (e.g., emergency lighting and power). In both, the field of usefulness is likely to be increased under war conditions, and the battery will, no doubt, tend to be installed as near the load as possible. Another consideration favourable to extended use of electricity storage is that the ability to derive alternative supplies from two undertakings does not necessarily mean complete duplication when both undertakings receive a bulk supply from the grid.

Industrial Lighting

SOME compensation for the dropping, due to the outbreak of war, of the projected E.D.A.—E.L.M.A. lighting campaign last autumn has now been provided by the publication of "Modern Factory Lighting." Copies of this instructive hand-book, which is reviewed in this issue, are being sent to some 25,000 large factories. It will form a valuable source of information to anyone interested in the relation between good lighting and efficient production as well as to those concerned with the more technical aspects. The section of most topical interest is that dealing with lighting in war-time, but it is the only part that is likely soon, we hope, to get out-of-date.

METER DESIGN

A Review of Modern Practice

By O. Howarth, M.I.E.E., M.Amer.I.E.E.

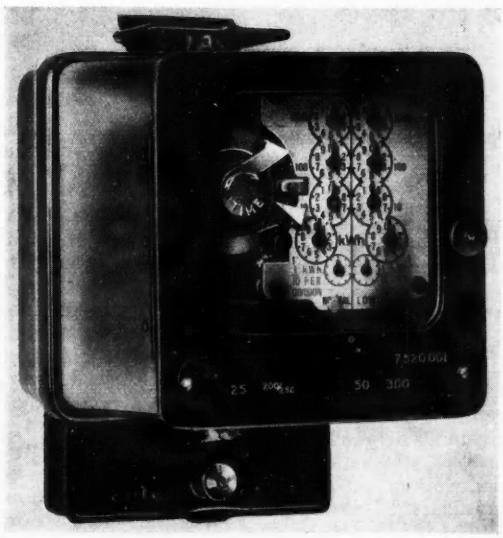
PERHAPS the most important recent tendency in electricity meter design is the provision of full temperature compensation for all power factors in induction meters. Considerable progress has been made in this direction, particularly by the Sangamo Co., and the success of its efforts has influenced other manufacturers who are gradually coming into line.

The effect of the war upon industry will undoubtedly make it difficult for manufacturers to maintain their gains in designs, more especially as consistency in the modern mass-produced induction meter depends so much upon consistency in the characteristics of the metals used in its construction, particularly the magnetic characteristics of the iron used. Variations will affect temperature and overload characteristics and it is doubtful whether the manufacturers will be able to maintain effectively all of the desirable features introduced during the last few years.

Mr. Howarth is with the Lancashire Electric Power Co.

The design of DC meters receives little encouragement owing to the decrease in need for these, but Ferranti, Ltd., and the Metropolitan-Vickers Electrical Co. supply compact DC ampere-hour meters which have a sufficient range of speed adjustment to enable them to be calibrated to a pre-determined constant.

Purchasers of meters are now keenly interested in consistency of errors owing to the advent of meter certification, and this is compelling manufacturers to pay greater attention to their gears in order to reduce the variation at low loads due to friction. The bottom bearing of the rotor has received much attention of late years, and it is now the practice to check the jewels to ensure that they are cut with the correct orientation to have a long life. The English Electric Co. offers a steel ball between sapphire cup jewels as an alternative to the conventional pivot and jewel. The top bearing has not received the attention it deserves, and it would no doubt be profitable for the E.R.A. to divert some of its attention from the bottom bearing to the top bearing of electricity meter rotors.



Ferranti two-rate single-phase meter with high- and low-rate dials and synchronous time switch incorporated in meter

Attention is being paid to the register bearings and to the weight and balance of some of the earlier wheels in the train of the register, with a view to reducing register friction, &c., to the minimum and maintaining it constant at all positions of the wheels. This is essential if reasonable consistency at 1/20th load is to be obtained. With the growth in the use of domestic appliances the range of load over which meters have to register has been considerably increased and although the price of kWh on a two-part tariff is very cheap, a considerable number of kWh may be used by consumers at a very light load, and the financial importance of 1/20th load is probably as great as ever it was.

The tendency in the past few years to use all-insulated cases is likely to be accentuated by the war, and it seems likely that the metal shell will become a rarity in the case of single-phase meters.

One of the objections in the past to all-insulated cases for prepayment meters has been that it is necessary to handle the framework of meters equipped with price-changing devices and with variable fixed-charge mechanisms.

This is a serious source of danger, should the framework of the meter become alive. The Metropolitan-Vickers Co. fits an earthing terminal to its all-insulated prepayment meters, which may be used merely as a terminal on which to put the earth wire when a meter change is effected, or to earth the framework inside the meter. This is a very desirable development and it is to be hoped that others will follow the example.

All two-part tariff prepayment meters have readily accessible devices for adjusting the weekly fixed charge. Smith Meters, Rex Meters, Landis & Gyr and the Electrical Apparatus Co. all provide convenient facilities for changing the kWh price on their flat rate meters and on their two-part tariff meters, and ready access is obtained by opening a window, which also gives access to the fixed-charge changing device in two-part tariff meters. This is a very useful development.

Robert Hornby supply a prepayment meter containing two ordinary single-phase induction meters, the standard size being rated 5 and 25 A respectively, and these are mechanically connected to a common prepayment mechanism. This permits separate flat rate tariffs for lighting and heating to be accommodated on the one prepayment mechanism. Independent price changing is provided for on each meter element.

Several detailed improvements have been made in the Metropolitan - Vickers load - rate meter, and there appears to be a growing appreciation of the usefulness of this type of prepayment meter. Most manufacturers are offering two or three coin prepayment meters as an option to the single coin. Many of them use a common slot for all coins. A useful addition to the two-part tariff mechanisms at present available would be the facility for setting the maximum arrears at any predetermined value from zero to, say, 20/-.

M.D. and Two-rate Types

The tendency in maximum demand indicator design has been to incorporate a synchronous motor timing device in the maximum demand mechanism. This avoids the necessity for external clocks, with their attendant liability to contact failures in the clock and relay trouble in the demand indicator mechanism. Another advantage is that when two or more demand indicators are in series, the clocks can be synchronised, or staggered, as required, and may be relied upon to keep in step. Ferranti, Ltd., now have available a commercial type maximum demand indicator incorporated in their stan-

dard commercial grade polyphase meter, having an internal synchronous clock to control the resetting device.

Metropolitan-Vickers, Ferranti and Landis & Gyr have made detailed improvements in their printometers where experience has shown such improvements to be necessary, and it is now possible to obtain apparatus of this type which will be reasonably reliable without undue attention, when installed in ordinary industrial premises. There may be an increased demand for these printometers to enable the maximum demand to be measured when alternative supplies are afforded to large industrial users at widely separated points to minimise the risk of interruption by enemy action.

Robert Hornby offer a maximum demand signalling device which gives an indication if a predetermined demand is being exceeded. An ordinary maximum demand indicator with a contact arranged to give an alarm when the demand is reached is useless for ordinary industrial purposes, as it would be necessary to switch the whole of the load off to prevent the demand being exceeded. The device offered by this company comprises a timing device which causes a pointer to advance at a rate which is predetermined by the load set up on the scale of this portion of the mechanism: a meter element advances a second pointer, and when this overtakes the other pointer the alarm is given. All that is then necessary is to reduce the load to or slightly below the predetermined maximum demand, and this will avoid the value being exceeded at the end of the demand indicator period. A Metropolitan-Vickers instrument works on a similar principle, but incorporates an additional device which provides for an alarm to be given if the average load from the commencement of the period falls below or exceeds the setting by predetermined amounts. Scales with adjustable pointers are fitted to enable these permitted divergencies to be set at suitable values.

Ferranti, Ltd., make a two-rate single-phase meter with the high- and low-rate dials and a time switch incorporated in the meter itself. The time switch is driven by a synchronous motor and provides for a maximum of two "on" and two "off" periods in twenty-four hours. The front of the meter cover can be opened to permit resetting of the times when necessary. The meter has been approved by the Electricity Commissioners.

Landis & Gyr prepayment meter with price change device from ¼d. to 9⅞d. per unit in steps of ¼d. Space on left of prepayment dials allows for insertion of fixed charge mechanism

Miscellaneous Accessories

Synchronous motors are becoming common in time switches, and some manufacturers offer a synchronous motor switch with a reserve in the clock to enable it to continue should the supply be interrupted.

One of the difficulties with ordinary 24-hour time switches is the necessity for rather complex week-end attachments to enable contacts to be made or broken at different times on Saturday and Sunday from other days in the week. It would be much simpler if we could have one week period time switches. It does not appear practicable to do this without having a fairly large diameter dial, which increases the size of the switch. Venner Time Switches now offer one which provides for a minimum "on" period of 1½ hours followed by a minimum "off" period of four hours, or vice-versa. Such a switch is less liable to be set incorrectly than the 24-hour type with the week-end attachment, and the same switch can be used for an "hold off" or "hold on" during the week-end. Sangamo offer current-transformers in all-insulated housings, which make them very suitable for use in situations where exposed conductors are undesirable.

Rotary Sub-standards

A number of manufacturers are now making rotary sub-standards suitable for use for testing meters under the Meters Act by methods A or B. Unfortunately, the requirements of the Act appear to be imperfectly understood by the designers of some of these meters, who supply a train of wheels indicating the revolutions of the disc up to 100, and another train indicating units. The standard size of meter offered is for 5 A at 230 V, and the unit dials go down to 1/100th of a unit, similar to the register of a standard 5 A at 230 V commercial meter. When used for testing meters by method A (dial test method) in conjunction with a 10/5-A transformer, or on the 10-A range in the case of a multi-range R.S.S., the unit dials on the R.S.S. only register half as much as the unit dials on the meters under test. In consequence, the test must be run to 2 units in order to obtain 10 revolutions of the pointer of the last dial on the R.S.S. On the 25-A range, 5 units must similarly be run off. This is a serious disadvantage as it considerably lengthens the time taken to test a batch of 10-A meters by method A.

The Metropolitan-Vickers Co. offers a rotary sub-standard meter having a constant of 1,000 revolutions per unit, which in effect provides for dials going down to 1/1,000th of a unit per revolution on the 5-A range, and this ensures that the revolutions of the last dial on the R.S.S. are invariably far greater in number than 10 revolutions on the last dial of the meters under test.

Meter Certification

It was inevitable that the operation of the Electricity Supply (Meters) Act, 1936, should alter the procedure in all testing stations, and it is desirable and was unavoidable that those undertakings which had not troubled to provide competent staffs and adequate equipment should be compelled to make considerable readjustments. It was unfortunate that the methods adopted for certifying meters included the issuing of regulations which bore hardly upon many well-equipped undertakings, both small and large, particularly those of long standing.

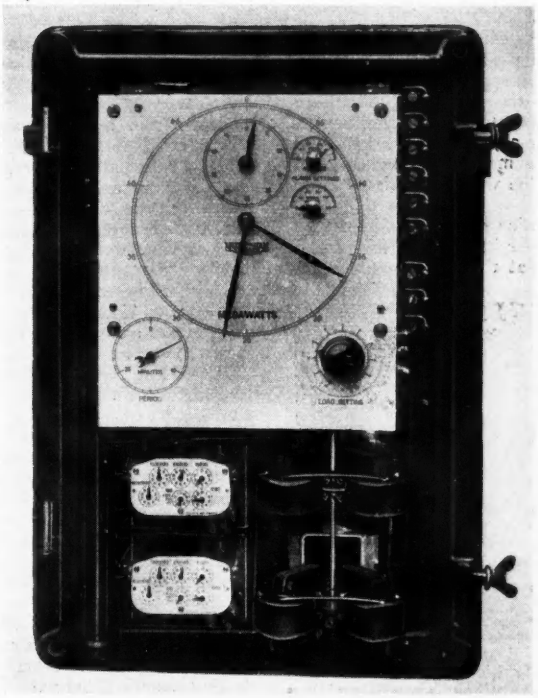
Regulations have been issued from time to time, some of which vary others previously issued. There has been no standard form of issue, with the result that the documents vary in size, making filing difficult. Some have the dates in one place and some in another, one refers to the date of another one in the title on the front page. The titles give one the impression that the first document was expected to be the last, with the result that the titles give little indication of sequence. All this makes it very difficult for anyone not in constant touch with certification to refer to particular regulations when the need arises.

It would facilitate reference and minimise the risk of non-compliance if the regulations were codified and issued as loose leaves in a suitable binder. When modifications or additions were made, new leaves could be substituted or added in their appropriate place. Such an arrangement would enable one to glance through all the regulations affecting, say, wattmeters in a few moments, instead of having to examine every document

issued to see if it contained any reference to wattmeters.

It would appear to be the plan to issue regulations covering every detail of the work of meter testing and meter handling, and we may expect them to come along with the relentlessness of a steam roller until they have flattened all testing stations to a dead level of mediocity, The habit of making regulations is a difficult one to break off, and we must not be surprised if they gradually permeate testing stations like a cancerous growth killing all life and initiative.

There are testing engineers with considerable experience of meter work who hold the view that the present method of operating the Act is unsatisfactory, because the final decision as to regulations rests with people who have had no experience of operating the meter department of a supply undertaking. The result is that irksome and unnecessary rules are established in some directions, which prevent competently staffed stations maintaining the accuracy of their instruments up to the standard they otherwise would, while allowing such loopholes in other directions that the examiner may be compelled to certify meters whose accuracy he doubts (with good reason) because the regulations have been complied with. For example, the examiner is not entitled to reject meters if they are within the specified limits when he tests them, using the wattmeter which the undertaking's staff used when the meters were tested. He would be testing the *consistency* rather than the *accuracy* of the meters, and if the regulations covering the wattmeter had been complied with he would have to accept it, although he might have good reasons for doubting its accuracy. He could, of course, take his own wattmeter next time.



Metropolitan-Vickers maximum demand alarm relay

The regulations leave nothing of importance to the judgment of the examiners who call, nor do they impose any standard of competence on the staff of the testing station. These are two serious omissions which will prevent the universal fulfilment of the intention of the Act.

Wartime Certification

A word about wartime certification may not be out of place. It is well known to experienced meter engineers that transport is an enemy of accuracy, and should be reduced to the minimum, and conditions carefully controlled. Undertakings were instructed in September to have their new meters certified at manufacturers' works and it was concluded that accuracy was being deliberately sacrificed to convenience. Under these circumstances one naturally expected some easement in the regulations requiring apparatus to be sent to the N.P.L. for approval or retest, but up to the time of writing there has been no modification. Undertakings rightly prefer not to subject their instruments to the risk of damage by aerial bombardment, or the rougher handling of wartime transport at a time when repair or replacement will be difficult or impossible. Possibly ways of overcoming this difficulty will be devised.

The sudden reduction in the number of examiners has inconvenienced many undertakings, which find that, on the whole, there has not been the expected drop in requirements. It was, of course, impossible to foresee with any accuracy just what would happen on the outbreak of war and errors of judgment were inevitable. The proposed arrangements for "postal" certification are liable to involve undertakings in very considerable trouble and expense if they should have any meters rejected under this scheme. It must be realised that rejection is much more likely with diminution of staffs in testing stations and with temporary replacements who cannot be expected to come up to the standard of reliability of those whom they replace.

It has been suggested that the Act should be suspended for the duration of the war, but there is little to be gained and much to be lost by doing this. Separate records would have to be kept of all uncertified meters issued, in order to facilitate their removal when the Act came into operation again. It is likely that the readjustment of record systems would impose additional burdens at least equal to any relief resulting from suspension of the Act. The most useful relief which can be accorded to undertakings is that sympathetic consideration shall be given to their individual difficulties. This will involve allowing discretion to the local examining staff. Will the authorities rise to the occasion?

American Instrument Technique

SINCE 1935 scientific publications in the U.S.A. alone have contributed nearly 900 descriptions of new apparatus to *Science Abstracts*. Attention is directed to a few of these developments, as representative of the general progress made in America, in the *Journal of Scientific Instruments* for January (The University, Reading, 2s. 8d. post free). The author is Dr. C. J. Overbeck, of the Northwestern University, Evanston, Ill., U.S.A., and among the matters he discusses are the production and maintenance of high vacua on a large scale, involving kinetic vacuum system technique, or "scientific super-plumbing" as it is sometimes called. Another interesting item mentioned is a valve with an oxide coated cathode which has its surface constantly renewed.

Accurate measurements of ultra-violet radiation in the stratosphere have been made by means of a radio-stratospheric ultra-violet meter developed by the Bureau of Standards. Various new developments in optics and acoustics also receive attention as well as new apparatus for demonstration and teaching. References are given in each instance to the original literature so that the reader may follow up any item of special interest.

Nickel Industry, 1939

WORLD consumption of nickel during the first ten months of 1939 totalled 206 million pounds and compared favourably with 160 million pounds in 1938. Mr. Robert C. Stanley, chairman and president of the International Nickel Co. of Canada, Ltd., states in his review of the nickel industry in 1939, that by the close of the year a record consumption would have been reached. This may be attributed to the great improvement in the heavy industries in the United States and Canada and to the general speeding up of industry in order to augment the production of war supplies. Mr. Stanley's review deals with world nickel consumption, products containing and industries using nickel steels and alloys. Sections dealing with heat resisting and electrical resistance alloys, electroplating, nickel in steam and electric power equipment and nickel in the electrical field indicate the increasing use of this metal in the electrical industry.

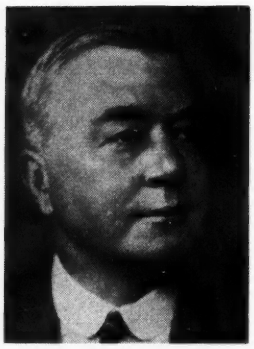
CERTIFICATION OF METERS

Methods in Time of Peace and War

By S. H. Richards, M.I.E.E., M.Amer.I.E.E.

THE practical application of the Electricity Supply (Meters) Act, 1936, has been productive of much commendation and condemnation. While it has been admitted generally that many of the conditions laid down by the Electricity Commissioners in their "Prescription of Apparatus" are not unreasonable, objections have here and there been raised to the accuracies demanded for standard and sub-standard apparatus in comparison with the limits of error allowed for meters.

The issue of the original specification of approved apparatus by the Commissioners, and the necessity for the certification of practically all meters, meant that the greater number of undertakings' test rooms had to be reorganised, in many cases rehoused, in order to conform with the requirements. Many interesting ideas and developments in the lay-out of testing departments and technique have been put into operation which have made for efficient working. Testing engineers now realise that standard apparatus is sacrosanct and should be housed, cared for, and used with precision.



Mr. Richards is Chief Meter Examiner to the Electricity Commissioners

The accuracy of a meter at the conclusion of test for certification is bound up with the known and unknown errors in standard and sub-standard apparatus, the errors of personnel and other factors for which a known constant cannot be applied. The visual illustration of these errors by Mr. G. F. Shotter (fig. 1) emphasises both the importance and the necessity for a closer appreciation of the accuracy of the standards as well as the need for accuracy in testing meters. His chart shows that the known errors must be allowed for, and the unknown ones catered for, if the meters are to be kept within the tolerances which have been laid down by the Electricity Commissioners.

While the main purpose is the checking and testing of consumers' meters, the importance of maintaining and sustaining accuracy of the standards is one which must be catered for, and fundamentally applied in order that the final accuracy of meters for service may be readily obtained and regularity of results maintained.

Laboratory Equipment

In the majority of cases the design and equipment of laboratory apparatus have been arranged to facilitate this work of checking sub-standards with the minimum amount of labour for operation and maintenance.

The potentiometer equipment of the Harrogate Corporation Electricity Department is one of many examples that can be cited of equipment which, while constantly in use, has been laid out and connected in such a way as to indicate an appreciation of the value placed on both labour and time in the testing of working sub-standards. This equipment is housed in an oak cabinet with a glazed dust-proof cover, and a special device for hoisting purposes, with four lockers fitted with low-voltage lamps and door switches. The voltage and current dual control units fit flush in the cabinet front, making faulty adjustment of pressure and current impossible.

The potential divider is a tapped resistance connected across the voltage battery. A multi-stud selector switch, in series with four multi-stud vernier resistances, taps the main resistance in shunt across the voltage battery and allows a voltage of the approximate value required to be selected. The final adjustment is made by the four verniers, the total resistance of each vernier being approximately equal to one twenty-fifth of the resistance of the vernier preceding it.

The current control unit consists of a series of fixed resistances brought into circuit by means of rotary back connected switches, the vernier control being carried out by four multi-stud vernier resistances. All resistances, including the vernier resistances, are connected in parallel, and control is possible from 0.001 to 150 A in increments of one mA. Standard resistances of 1.5 and 6.0 A at 1.5 V are mounted on a "Sindanyo" panel with link switching arrangements. Provision has also been made for resistances up to 150 A. The four lockers contain the standard resistance, volt box, Weston cells, and low-voltage batteries respectively.

On the test-bench are two DC two-range potentiometers and two spot type galvanometers with self-contained transformers and lamps. On the back panel are a shunted ammeter and a two-range voltmeter, in order to ascertain the approximate current and voltage on the equipment before actually energising the precision instruments. All the interconnecting cables are brought out through this panel and suitably marked with ivorine labels. The test bench is lighted by three adjustable bracket lamps with reflector type shades.

The battery provides 12 Ah (rating 100 hr.) at 600 V and two cells of 75 Ah (rating 10 hr.) at 4 V. All potentiometer connections are permanent and the cover, when lowered, encloses the entire equipment.

The testing station at Newbury (fig. 2) was designed by the Wessex Electricity Co. to serve a very large rural area, in conjunction with the testing station at Salisbury. The building has a loading bay at the north end large enough to house two small vans under cover. The meters are taken into the stores on the west side, and either stacked on shelves or hung on expanded metal racks until required for test.

The "cleaning" and "off service" test room is so situated that dirty meters cannot find their way into the final test room, and work is not done on a meter before its initial error has been ascertained. The next room in order is the workshop where off-service meters are stripped and cleaned, new parts being supplied when required. Pivots, jewels and registers are cleaned in a separate room and returned to the mechanic when he is ready to replace them in the meter. The mains testing room is fitted with single-phase racks similar in design to those used by the North Metropolitan Electric Supply Co., Ltd. The loading bench and sub-standard are in the centre of the meters under test.

The meters required by the examiner are connected to a separate bench which is provided with "whole current" wattmeters, so that current transformers are not necessary for the certification of single-phase meters. A polyphase test set is also accommodated to deal with meters up to 600-A capacity with their associated current transformers. The records of meter tests are handed through a window into the office, for entering upon record cards by the record clerk.

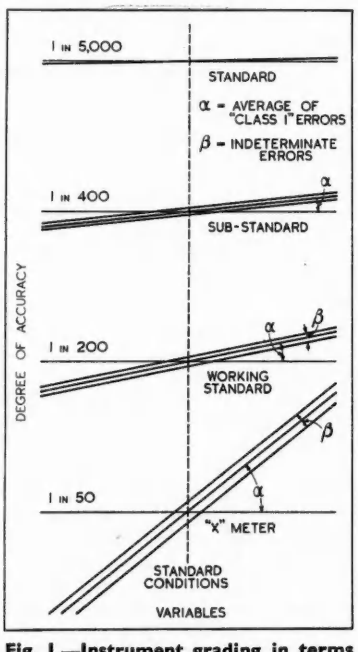


Fig. 1.—Instrument grading in terms of error (Shotter)

Metering current and voltage transformers are tested against an Elliott-Shotter test set, in a room adjoining the loading bay, the test set being arranged with the high-voltage loading transformer and its cage on one side, and the current loading transformer on the other. It is not necessary therefore constantly to transport oil-filled transformers through the Department. The potentiometer batteries and incoming mains are at the north end of the building so that there is no possibility of fumes finding their way into the laboratories or stores. There is no direct access from this room into any of the test rooms or workshop. Protective relay testing is dealt with in the main test room on a bench fitted with a loading transformer and timing device.

The initial cost of the single storey building was low, and the economy of operation under the routine planned will be worth the expenditure on a new building.

In view of the number of meters that is tested by a single rotating sub-standard meter per day at Salisbury and the reliance which must be placed on this sub-standard to maintain the accuracy of meters, it is considered advisable by this company that a daily check should be taken on each sub-standard used. In this case, the moving of rotating sub-standards to the standardising laboratory to make this daily test is economically impracticable. But by means of a relay operated from the standard laboratory clock, so that the sub-standards are connected direct to the clock and the standard wattmeter without removal from the test benches, it is possible for all the rotating sub-standards to be tested at once. The procedure is simple and the schematic diagram of the arrangement is given in fig. 3.

The voltage circuit of the rotating sub-standard is permanently energised, but the current circuit is disconnected at night so that the dial tests are made with the sub-standards in the same condition each day. Every morning the four leads of the rotating sub-standards are connected to the standardising terminals on the bench. The voltage lead is, however, broken at the contactor relay which is actuated by the standard clock, so that the load may be adjusted on the wattmeter prior to the commencement of the test. The sub-standard pointers are all reset to zero and the tester responsible for holding the load, switches the standard clock impulses on to the relay, so that the voltage is made to the sub-standards under the control of the clock for definite and accurate periods of one or more minutes as desired.

The error of the standard is found by noting the difference between the nominal revolutions which the sub-standard would have made if the wattmeter had no error, and the actual revolutions in the period of the test. The error of the wattmeter and current transformer (if any) is allowed for after the apparent error of the sub-standard has been obtained. Each day a different range is tested at 100 per cent. and 5 per cent. load, so that all the sub-standards are completely tested in approximately one week. The time taken each morning is 15 minutes.

It has been my practice, in the lay-out of testing departments, to establish permanent connections from the wattmeters and rotating sub-standards on all testing benches to the standards room in order that at periodic intervals all instruments on the test benches can be tested either individually or collectively against the potentiometers with the minima of time and cost. While this method involves additional expenditure in wiring and switchgear, it has the added advantage of testing wattmeters and rotating sub-standards *in situ*, thus obviating the necessity for the removal of instruments. It has been evident from observation that some of the errors which have developed in instruments have been due to careless handling in removal between test and check positions. The added advantage of permanent testing connections more than compensates for the extra cost involved.

Trend in Accuracy

The Commissioners require a meter to be within the limits of 3½ per cent. slow and 2½ per cent. fast and tests are made by examiners at one-tenth, intermediate and either full or overload, depending upon the type of meter, together with the other tests laid down in the "Prescription of Apparatus." The limits of accuracy were advisedly extended and simplified in comparison with the previous ones because the number of meters of fairly old pattern on circuit and the twentieth-load test for quarterly and prepayment meters presented difficulty.

Certification of meters voluntarily put forward in December, 1937, indicated that the limits allowed were in many cases either barely wide enough or that test engineers lacked appreciation that a closer band than 2½-3½ per cent. was necessary in order to allow a tolerance for the meter examiner's test. In consequence, rejections were high. These materially decreased by July 1st, 1938, the appointed day for certification; from that date to the end of 1939 accuracies obtained were approximately 1½ per cent. better than they were in July, 1938, and rejections have fallen to a negligible quantity, excepting in a few cases.

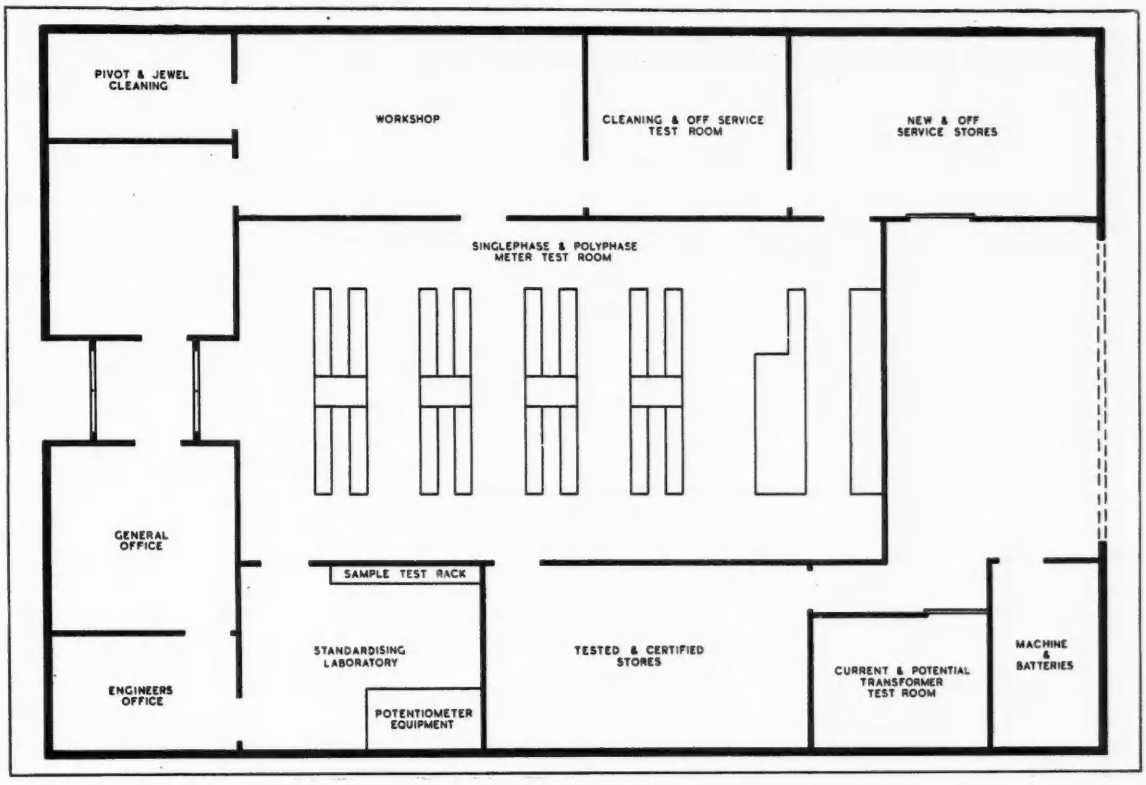


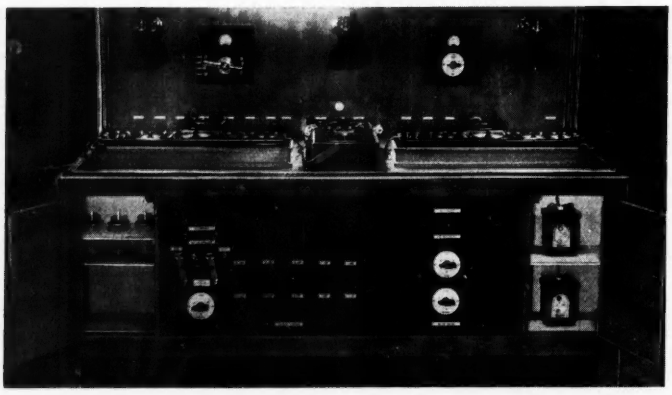
Fig. 2.—Layout of meter testing station at Newbury (Wessex Co.)

During 1937 and 1938 the Electricity Commissioners appointed thirty examiners to undertake the work of certification. The country was divided into seven main areas, each under the direction of an area meter examiner. Each of the seven main areas was divided into sub-areas operated by assistant meter examiners. Itineraries were mapped out whereby undertakings obtained the maximum number of visits in accordance with the number of meters tested. These visits varied from one or two per week to one visit every six weeks or three months in accordance with the requirements of the particular undertaking.

During the initial stages of certification areas were handicapped because of difficulty in obtaining the essential equipment, and a good deal of apparatus was accepted on a temporary basis. In June, 1937, the Commissioners issued a pamphlet dealing with approved apparatus for testing stations for the examination and certification of electricity meters. It was compiled with the help of a technical committee of the industry and representatives of the National Physical Laboratory. All its provisions, which in some instances

have been looked upon as unnecessarily harsh (although it must be pointed out that they were agreed to by the industry prior to acceptance) have been found to be of fundamental importance in the preservation of accuracy in test rooms in general. The specifications laid down in this document have proved of great value in their application to meter testing in general.

Criticisms with respect to adherence to such requirements have often been made, but, in general, they have not been valid, as two years' working of the Act has indicated that they are vital and necessary. While the document already referred to limited the scope and type of apparatus to be obtained after June 1st, 1937, it did not preclude sanction for much that existed prior to that date, as the Commissioners reserved the right to prescribe or approve standard or sub-standard apparatus other than that laid down, when it appeared to them that circumstances enabled such apparatus to be employed for the remainder of its useful life. In consequence, undertakings with such apparatus have always had an opportunity of obtaining temporary approval for the useful life of any apparatus outside the specified document.



Potentiometer equipment at Harrogate Corporation testing station

In the final appendix to this document the methods for meter testing and actual tests are given. The three methods generally agreed upon are briefly: Method A. Long period dial tests using sub-standard rotating meters. Method B. Tests (other than long period dial tests with sub-standard rotating meters). Method C. Tests by sub-standard indicating instruments and stop-watch. The actual tests for DC and AC meters are detailed.

During subsequent months certain modifications with respect to apparatus and testing procedure were issued in various documents. It should be pointed out that these were complementary to the original document and were in no way supplementary to the original requirements. In other words, so long as the requirements laid down in the original document were adhered to, the apparatus specified in further documents was allowed in view of certain undertakings desiring apparatus not considered essential, but felt to be desirable in special cases. This new apparatus was permissive, but not mandatory.

While the original and succeeding documents deal in detail with the requirements laid down for new instruments, they did not deal with the continuing acceptance of such apparatus if, after having been accepted for use, such apparatus should be "burnt out" or damaged in any way, thereby invalidating the certificate of acceptance on a continuing basis. Unfortunately, new apparatus had not been long in use when difficulties due to various causes, such as "burn outs" and careless handling, invalidated it for further testing.

The Commissioners therefore reconstituted the technical committee to deal with the use of standard and sub-standard apparatus and its continuing use after repair. A discussion in committee on the various points involved, emphasised the need for a complete investigation into factors affecting the use of apparatus on circuit and its care and maintenance. This investigation was finally extended to consideration of the organisation, and in some cases the reorganisation, of testing departments in order that commercially efficient methods might be developed, as a pointer to testing engineers who were not so fortunately placed as others.

Test room at Harrogate with centralised sub-standard testing equipment on each bench and means for corrective dial and revolution testing

This work had materially advanced when hostilities broke out and the committee temporarily ceased to function. The work was of such a nature as generally to produce a feeling that the documents upon which they were engaged must ultimately be of value to the industry in general. Much of the ground covered is new; consideration is being given to every point at issue, and to the possibility of further complementary apparatus and testing methods being allowed in testing stations.

Operation of the Act

Prior to the war the operation of the Act had to be considered on an economic basis, and one which would give an adequate guarantee that the accuracies demanded would be obtained. Two possible methods were that (1) all meters tested by the undertaking should be retested for examination and certification; (2) a percentage of the meters tested by the undertaking should be tested by the examiner in order to release the batch awaiting certification.

It was evident that if the first method were adopted the cost to the industry in personnel withdrawn as examiners, and therefore cost per meter, would be a heavy one. It was finally agreed that a 5 per cent. basis under normal conditions should be the minimum number accepted for test, subject to the proviso that when any meters taken from a batch for certification and test failed, a further 5 per cent. should be taken by the examiner, and a decision arrived at with respect to the batch in the light of tests. Experience has already shown that the method adopted has been quite satisfactory. At the same time, it has reduced the cost from what it might have been had all meters been tested by the examiners for certification.

Itineraries for examiners were drawn up on the basis of the number of meters to be tested and visits arranged accordingly. It was obviously impossible, with the number of meters to be certified, to equalise the number of visits among the undertakings, since the number of meters tested by individual undertakers varied between 100,000 and 200 per annum. The obvious and reasonable method was therefore to consider the number of visits to a testing station in relation to the number of meters which had to be tested for certification. As a general principle, it was decided that if a testing station had between 500 and 600 meters per week it should be given a weekly visit. In the case of undertakings with a very much smaller number of meters, the visits would decrease accordingly, with the minimum of a visit once every three months.

Such a procedure placed undertakings under an obligation to retain a stock of certified meters which would be sufficient for their requirements between visits of an examiner, but it was unofficially suggested that material advantage would arise to the undertaking if a sufficient stock was maintained to carry an undertaking over two visits of an examiner who because of illness, fog, etc., might be unable to attend at his normal visiting period. The arrangement worked satisfactorily, except in a few instances in which undertakings lived from hand to mouth with respect to certified meters, or abnormal calls were made upon certified meter stocks. In such instances, special visits were made; in no case has an undertaking been left without certified meters.

Certification During the War

The crisis of September, 1938, made it evident that a reorganisation of the Commissioners' examining staff and the testing of meters for certification would be necessary in the event of war and that the following conditions would apply: 1. Reduction of the testing staff due to individuals being called up for military service. 2. The reduction of new service con-

nections. 3. Undertakings restricting the change-over of meters during the ten-year period, except for faulty meters.

Up to September, 1938, there was every indication that the number of meters to be certified per year would be between 2½ and 3 millions, but the views expressed by many undertakings indicated that the number of meters needing certification during any year of hostility would vary between 250,000 and 500,000. It was necessary, therefore, to consider reorganisation in order that a satisfactory basis could be agreed upon for certification, and the efficiency of the apparatus used for the testing maintained. In the event of an attack there was reason to believe that traffic dislocation would interfere with the return of the standards or sub-standards needing re-checking to the National Physical Laboratory, for acceptance for use on a continuing basis.

While nothing has been fully determined upon, consideration has been given to these factors so that the normal procedure in testing meters and the efficient use of instruments can be maintained. Consideration had been given as well to the possibility of a number of testing stations being closed for various reasons, and arrangements were considered whereby such undertakings could obtain certified meters with the minimum of effort. These possibilities suggested one of three courses, or a combination of three, in the event of hostilities:—

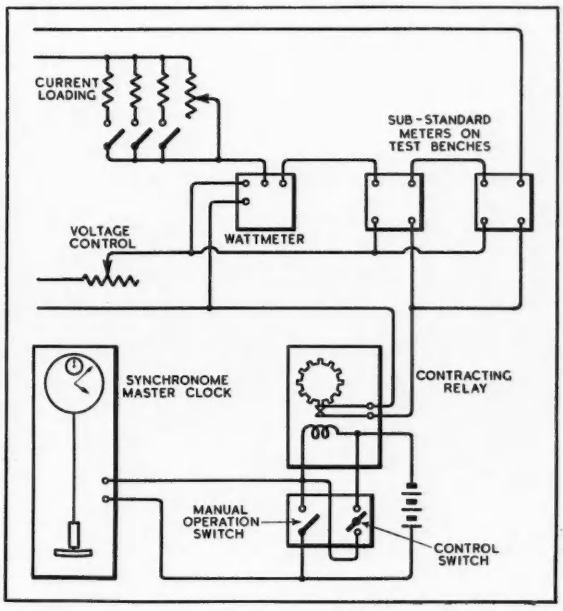


Fig. 3.—Schematic diagram for daily checking of rotary sub-standards with clock-operated relay contactor

(1) The centralisation of testing in the testing stations of the larger undertakings situated geographically in such positions as to obviate the necessity for long journeys by road or rail. If this suggestion were adopted, one of the major difficulties would be the closing down of a number of the testing stations belonging to the smaller undertakings which have been developed at considerable expense, and at the same time, are worthy of consideration and retention; a further question to be faced was the possibility of a charge for testing and repair which would be beyond the normal figure obtaining in such test rooms. The immediate necessities of the industry and the progress of events indicated that such drastic measures did not require immediate attention. This method, however, could be put into practical operation in the event of hostilities seriously interfering with the transport conditions in the country.

(2) The use of manufacturers' test rooms on a temporary basis for meter certification. This suggestion was adopted after negotiation with the Meter Manufacturers' Association and has proved successful.

(3) A considerable reduction in the visits of examiners to testing stations.

Suggestions (2) and (3) were put into effect when hostilities commenced and several months' working has indicated the feasibility of such a scheme. One of the major difficulties in the initial stages was that the anticipated fall in number of meters required for new services did not occur, due to installations in A.R.P. shelters, wardens' posts, &c.; while in many areas where the number usually required had been small, a very large increase of meters installed was noted due to the reception of evacuees. The tendency at present, however, is towards a general decrease in the requirements of the undertakings until it becomes evident than the scheme now in force is not only feasible but practicable as well, and that the meters required will be reduced to the number previously stated.

I have to record with pleasure the general cordial support and co-operation of the electricity supply undertakings in the operation of this Act and the minimum of difficulties and trouble that have arisen in connection with its administration by the Commissioners.

New Sliding-rate Meter

OF all the methods of allocating the standing charges according to the consumers' demands, those based on maximum-demand indicators are the soundest from the technical point of view. However, it has been repeatedly stressed that the charges arrived at in this way are, in practice, both unfair and inconvenient to the consumer.

Improvements of the demand charging system have been effected by means of peak-load meters, load-levelling relays and time switches, as well as by various refinements of the tariffs, but these have been limited in their application. Therefore, either the shortcomings of conventional m.d. indicators must be tolerated, or else any idea of checking the consumer's load curve has to be abandoned, even in cases in which the diversity of the supply is inadequate.

A more rational and simple system of charging, without any necessity for providing duplicate measuring instruments or wiring, is claimed to be made possible by the use of a new meter which is described by Dr.-Eng. M. Unz (Iraq Petroleum Co., Ltd.) in the *I.E.E. Journal*.

This instrument is intended to replace m.d. indicators. It works in the same way as a watt-hour meter, but its readings do not indicate kWh. Instead, the figures registered are proportional to the payments due, since the new meter automatically fixes the price level of each consumed "unit" as a function of the power at which it is supplied, and integrates such prices to a total amount.

In this way a sliding-rate tariff is made possible, free from all the drawbacks of m.d. indicators. The consumer would know that the price of a "unit" consumed at half load is much lower than that for a "unit" consumed at double full load. He could endeavour to reduce his electricity bill by improving the load factor to the utmost, but would never be afraid of being penalised for exceeding his usual demands. The running charge could be determined according to a block tariff; substantial reductions could be offered for continuous loads under minimum-payment guarantees.

An integrating watt-hour meter whose speed characteristic is represented by a curve instead of a straight line will serve the purpose. Its readings would be termed "key units," proportional to the amounts of money due, as in load-rate prepayment meters or in double-tariff meters with a single counter train.

The tangent to the curves at the origin of co-ordinates can be regarded as the characteristic of a standard meter, having the same speeds for small loads as the meters represented by the curves. This tangent is used as a baseline for the discussion of the meter characteristic, and the ratio of the actual meter speed to the speed corresponding to the baseline indicates the average increase of the "unit" price at rising demand, and is called the "speed increase" or "rate increase" factor.

The law defining the varying values of the units consumed at different demands is introduced into the meter by modifying its load/speed curve. The new performance of the meter is obtained by altering the features of the magnetic brake, introducing stray reactance.

The paper describes the constructional details of the proposed braking element, its equivalent electric circuit is considered, and its performance discussed. The reconstruction of the meter characteristic is outlined, and the errors and compensation methods briefly discussed.

A high ratio of the stray inductance to the resistance of the braking circuit is desirable, in order to meet practical tariff requirements and to improve the accuracy. By properly combining different braking circuits, adequate variation of the load/speed curves can be obtained.

The balancing and the calibration of the device are more elaborate than in the case of a standard watt-hour meter. The instrument is also more sensitive to rough handling, but in comparison with maximum-demand indicators the sliding-scale meter appears simpler, has smaller losses, and is more reliable in operation. It is considered that the meter should be particularly suitable for use on networks on which the load factor is bad.

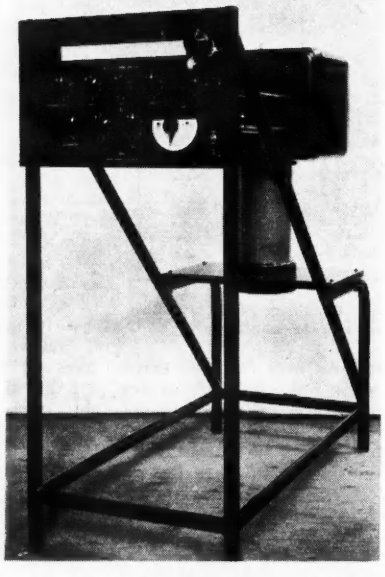
ELECTRICAL INSTRUMENTS

Recent Development and Improvements

By G. F. Shotter, M.I.E.E.

THE Physical Society's Exhibition has been missed, especially by those who have attended it regularly for years past and have always looked forward to it as an annual event of outstanding scientific and engineering interest. The Exhibition normally gives members and visitors a unique opportunity of inspecting an extremely wide range of apparatus and thus they can judge for themselves progress which has been made during the past year. Without such an opportunity it is not easy to ascertain the real extent of the development which has taken place. Furthermore, the war has no doubt retarded the production of many new instruments.

It is, therefore, possible to outline a few only of the developments announced by manufacturers, and it is intended to mention only those which appear to the author to be of major interest.



Cambridge Universal Schering bridge

Among the new instruments produced by the Cambridge Instrument Co., Ltd., is a "Universal" Schering bridge for the measurement of power factor (loss angle) and capacity of high-voltage bushings and similar insulators. It has a self-contained standard condenser and can be used with the inverted or non-inverted connection for measurements on earthed or insulated condensers with a high voltage supply which is bonded to earth on one side. The operating panel is earthed and is supported in a frame carrying the insulated high-voltage standard condenser, and a shielded case containing the ratio arms and galvanometer. The controls between the earth panel and the shielded case are insulated to twice the maximum working voltage of the bridge which is 35 kV RMS; the capacity range is 30 to 10,000 μF and the power-factor range is 0.001 to 0.11. In this form, the instrument should prove an asset for the routine checking of high-voltage bushings and insulators.

Another Cambridge development is a new model of the "E.M." oscillograph to facilitate the recording of short-circuit tests on high power switchgear under industrial conditions. It has 12 elements and incorporates a new continuous paper camera to overcome the difficulty in this type of work of synchronising the oscillograph record with the break of the switch contacts.

The same company has also produced a compact portable field oscillograph of the permanent magnetic type, which is interesting in that it is complete with a camera and is independent of any external source of supply other than that from a 12-V accumulator. It is claimed that the quality of its records is comparable with that obtained from more elaborate equipment. The development of the portable cathode-ray oscillograph would now seem to have brought about its counterpart in the portable electro-magnetic oscillograph, and by "portable" the author means easily carried by hand.

For the measurement of voltage in high-frequency circuits there are new Cambridge dry rectifier high-frequency voltmeters. These have a high input impedance and are stated to be accurate at frequencies up to 10^5 cycles per second. The voltmeters are available with ranges from 0.25 to 100 V, and appear to have good characteristics.

Of considerable use in many laboratories is a Cambridge multi-range voltmeter of the diode pattern suitable for use at frequencies from 20 cycles to 50 megacycles. To reduce errors at very h.f. due to long leads, the whole of the h.f. measuring circuit is mounted in a probe which may be put right up to the points across which the voltage has to be measured. The probe is connected to the indicator through a six-foot flexible cable carrying only DC. At low frequencies the cable may be disconnected and the probe plugged directly on to the indicator panel. Although the standard instruments are calibrated for RMS voltages, the instrument can be especially calibrated to read peak values for particular applications. The voltmeter is operated from a single self-contained dry battery and provision is made for the use of a 4 V accumulator if required.

Measuring Very Low Resistances

A recent introduction of the Automatic Coil Winder and Electrical Equipment Co., Ltd., is the "Avo" bonding meter for applications which involve the measurement of very low resistances. It utilises a crossed coil movement, which is substantially independent of testing voltage. The dimensions of the instrument are: 5¼ in. by 4⅝ in. by 7⅝ in., and it has a 4-in. scale calibrated uniformly into 50 divisions with range values from 0-10 milliohms to 0-1 ohm, according to requirements. A 10-Ah nickel-iron accumulator in the rear of the instrument provides the testing voltage. The standard leads are 3 ft. long and they plug into the meter, testing handles with spikes being fitted to their outer end. The "Avo" bonding meter is portable; its weight is only 5¼ lb. excluding the leads.

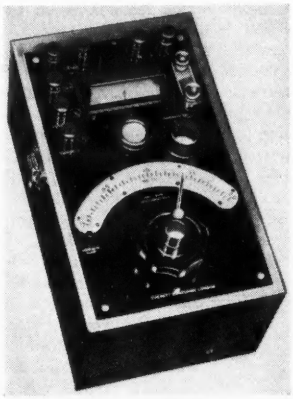
A somewhat similar instrument is the "Avo" milliohmmeter, a double-range type with a change-over switch, which requires an external 2-V accumulator for operation. A choice of ranges is again available, the lowest in this case being 0-1 milliohm, with a maximum of 0-1 ohm. The size is 5¼ in. by 4⅝ in. by 4 in., the weight being 3 lb. There is also an "Avo" test bridge and the latest "Avometer" is known as the "Model 40 Universal."

In a normal wattmeter the full-scale deflection in watts usually corresponds with not less than, say, one-fifth of the product of the rated current and rated voltage. For many purposes this sensitivity is nothing like high enough and Everett, Edgecumbe and Co., Ltd., have recently introduced a thoroughly robust instrument in which this fraction is about 1/200th or less. It is of the electrodynamic pattern and the moving element carries a mirror by means of which a clearly defined line is projected upon a translucent scale plate. The moving element is suspended by a robust ligament from the torsion head carrying a pointer which is arranged to move over a long and evenly divided scale.

"Avo" bonding meter, and left, milliohmmeter

These wattmeters have a number of applications, of which two may be mentioned. In the measurement of iron losses not only is the power factor extremely low, but it is essential, in order to prevent flux wave-form distortion, that the ohmic resistance of the current winding should be negligible

compared with the reactance of the magnetising circuit. With a full-scale deflection with 2 W at 50 V the ohmic resistance of the current windings is only 0.05 ohm. The watt loss in the voltage circuit is also extremely small, amounting to only 0.15 W at 50 V. This is an important feature since, if desired, the volt circuit may be connected across the terminals of the magnetising coil of the test circuit. Another purpose for which these wattmeters are particularly suitable is for the measurement of the watt loss in high-voltage dielectrics and insulators. The current in this case is extremely small and for this reason is passed through the moving coil of the wattmeter which thus forms the current element.

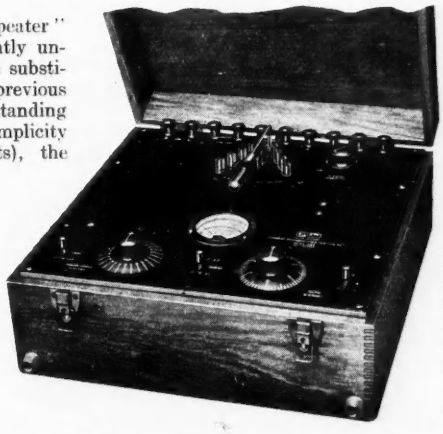


Everett Edgcumbe wattmeter for very low p.f. measurements, and right, explanatory diagram

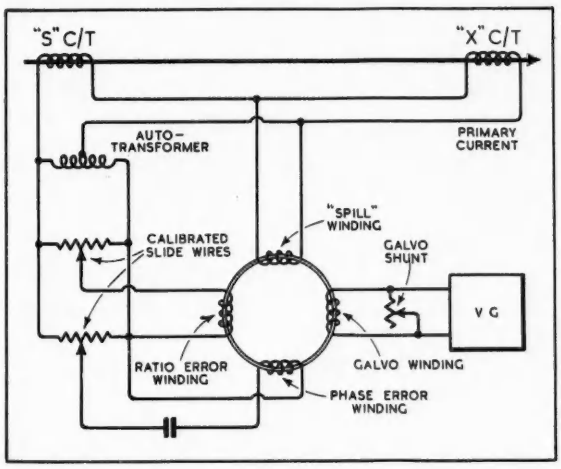
In most cases the watt loss has to be measured at say, 10,000 or 22,000 V, and either a high series resistance can be used or, as is usually more convenient, a step-down voltage transformer may be connected across the test piece. With either method there will inevitably be some phase displacement between the voltage and current in the voltage winding. So that phase displacement shall be reduced to zero a variable compensating adjustor may be embodied; this consists of a condenser-shunted series resistor, above the scale and conveniently covering an adjustment of from 10 minutes lag to 30 minutes lead. A feature of these instruments is the extremely small watt loss in the current element. In a particular instrument scaled to 2 W at 12,000 V the watt loss amounted to only 5 μW when carrying a current corresponding to full scale deflection at unity power factor.

The Everett Edgcumbe "Auto-repeater" system of distant indication has recently undergone a radical improvement in the substitution of gas-filled relays for the previous electro-magnetic relays. The outstanding features of this system are extreme simplicity (there are only three moving parts), the absence of current carrying contacts (they merely apply a voltage to the valve grids and carry no appreciable current), and the use of normal moving-coil indicating or graphic instruments of any desired pattern at the receiving end.

A new product of Elliott Brothers,

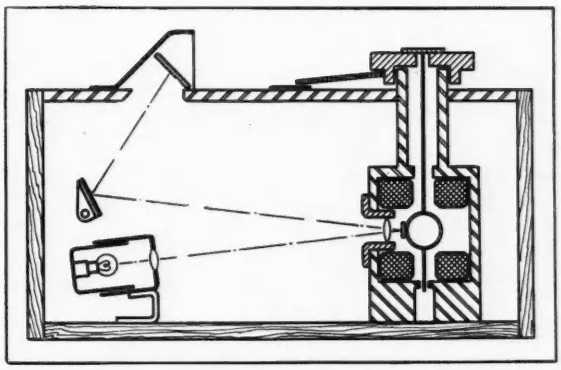


Petch-Elliott current transformer testing set, and schematic diagram



Ltd., is a Petch-Elliott current transformer testing set which is extremely accurate and compact, and it should prove a very useful addition to existing apparatus, particularly in connection with the testing of standard transformers for use under the Electricity Supply (Meters) Act, 1936. The set has several advantages, among which are that it is self-contained, with the exception of the vibration galvanometer and standard transformer; it is truly portable; no auxiliary supplies are required; and no phase-shifting transformer is necessary. It is arranged for the testing of 5, 1 or 0.5 A. secondaries. The burden imposed on the transformer under test is less than 0.1 VA, and the burden on the standard transformer is 1.5 VA.

Briefly, the S and X transformers are traversed by a common primary current and their secondaries are connected to "circulate." In these circumstances the "spill" winding carries a small current which is the vector sum of currents proportional to the ratio and phase errors of the X transformer (assuming for the moment that the standard transformer, S, has no error). In operation, the flux produced by the "spill" current is neutralised by current supplied to two



other windings on the toroid core, one of these windings being supplied with current in phase with the standard secondary current, and the other by a current in quadrature. When neutralisation, as indicated by the vibration galvanometer, is obtained, the value of the two component currents injected is a measure of the ratio and phase angle errors of the X transformer. These errors are directly indicated on two dials on the test set.

A new design of Elliott iron cored recording wattmeter has also been made available in single, double and triple element patterns, designed for a declared frequency. Owing to the nature of the magnetic circuit, it has been possible to reduce the consumption of the current circuit to 5VA without sacrificing control. The inertia of the moving element is small and consequently magnetic damping is employed and the use of oil is thus avoided. These instruments are available in portable and switchboard patterns.

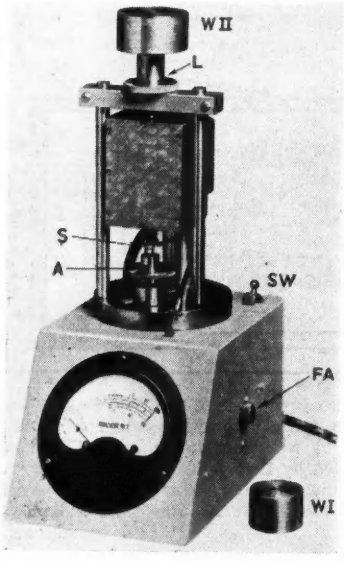
For remote control and indication in mines Elliott equipment is designed to perform the following functions:—(1) Automatically start and stop an underground electrically driven pump at predetermined high and low water levels in an underground sump. (2) Indicate the level in the sump above ground. (3) Remote indicate, over a G.P.O. line two miles long, the level in the sump. (4) Remote record, over a G.P.O. line two miles long, the level in the sump. (5) Give an audible alarm at the distant point if the sump level exceeds a predetermined high level. (6) Give an audible alarm at the distant point if the AC supply to the transmitting, controlling or alarm equipment fails. (7) Give an audible alarm at the distant point if the underground pump motor temperature exceeds 120 deg. F. (8) Give an audible alarm at the distant point if the air temperature in the underground pump room exceeds 120 deg. F. (9) Automatically shut down the pump motor if its temperature exceeds 120 deg. F. The motor will automatically restart when normal temperature is attained.

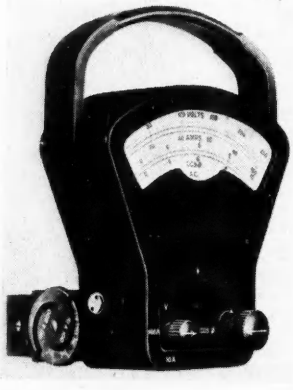
The equipment complies with the requirements of the Mines Department, and as it operates over G.P.O. lines, also with Post Office regulations. This is a noteworthy example of the development of remote control and indication work. The main control relay is an 8-in. dial moving coil instrument incorporating an "Alnico" steel magnet and has a full scale torque in excess of 20 grm. cm. and an energy consumption of less than 10 mW.

A development of Elliott Bros., arising out of the requirements of the Electricity Supply (Meters) Act, 1936, is a peak comparator, which enables the peak factor of the incoming

voltage supply wave to be compared with the current and voltage waves supplied by various transformers and apparatus used in connection with meter testing. The equipment consists of three units in separate portable cases. The first is the instrument proper and deals with voltages, 200 to 250; the second is an auxiliary unit for voltages down to 8 V and is particularly useful for use on step-down transformers for current supply; the third is another auxiliary unit for comparing the output current wave forms from such current supply transformers. A neon lamp is the detector and the peak factor is read directly off a dial. The detection of a peak factor not over 3 per cent. is not an easy task on an oscillograph and consequently this peak comparator should prove useful.

An addition to instruments using the valve voltmeter principle is a new thermionic test set made by Salford Electrical Instruments, Ltd. This is direct reading and has a patented circuit of the DC amplifier type using negative feedback with a potentiometer input. The instrument measures AC or





Salford hardness and all-circuit testers

DC voltage and current and may be supplied for either battery or mains operation. The ranges covered on AC are from 0.005 μA to 5 A and from 50 mV to 500 V at frequencies from 25 cycles to 20 megacycles. On DC the range is from 0.0005 μA to 1 A and from 1 mV to 500 V. The impedance of the instrument at audio frequencies when used as a voltmeter is 10 megohms.

An interesting sidelight on the ever-increasing use of electrical methods of measurement in industry is evidenced in the Salford tester for determining the hardness of thin metal sheets or foils. It makes an impression of only two or three thousandths of a millimetre and is therefore suitable for materials of a thickness of the order two or three hundredths of a millimetre. The instrument incorporates a micrometer of the electrical induction type, the movements of which are indicated by a galvanometer. A load applied through a steel ball 1/16th of an inch in diameter makes an impression on the metal under test. Movement of the spindle causes a movement of an iron core between the electro-magnets which are parts of a Wheatstone bridge. This movement produces a change of inductance of the electro-magnets, unbalancing the bridge system, thus giving a reading on an indicating instrument in the bridge circuit, which operates from the standard 230 V 50 cycle supply. A special compensating circuit, employing inductances and condensers, ensures that the accuracy is unaffected by fluctuations of mains voltage. The instrument has an advantage over the Rockwell tester in that it is possible to ensure more accurate measurements for very thin sheets and foils.

Another new Salford device is the Tait layer meter for the measurement of the thickness of nickel plating on non-magnetic bases. It is provided with an exploring head containing a small transformer and the nickel magnetic layer completes the magnetic circuit of this transformer, variations in the thickness of the layer causing variations in the reluctance of the transformer iron circuit. A constant current passes through the primary of the transformer and the current due to the voltage induced in the secondary winding is indicated. The voltage is inversely proportional to the reluctance of the layer, and therefore to its thickness.

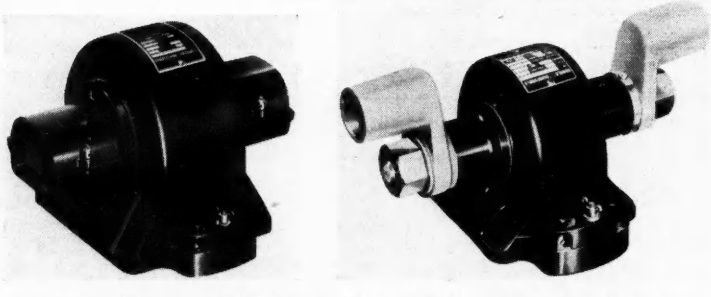
The Salford organisation has added a link test AC ammeter to the existing patterns already on the market, and an instrument called an "all-circuit tester." It comprises an open-core transformer, the limbs of which project at the back of the instrument so that they may be placed astride the current-carrying conductor. A secondary winding provides the very small current necessary to operate a high-grade moving coil instrument through a full wave metal rectifier. The voltage circuit is normal, the moving element and rectifier being fed through series resistances in the usual way.

For power factor measurements, an additional winding on the transformer, which is normally open circuited, is placed in series with the voltmeter circuit by means of a range switch. It is claimed that in addition to measuring current, voltage, power factor (single-phase and three-phase), calculation of power (single-phase power, three-phase balanced power, three-phase unbalanced power) and measurement of idle power-factor the instrument can also be used for fault locating and additional measurements, such as resistance and capacity by calculation, contact drops on switches and fuses and can be used for detecting defective coils in transformers and machines. This seems to be a truly universal tester which bids fair to eliminate a multitudinous number of instruments now in use! With regard to operation for the measurement of power factor, the information contained in this firm's publication is somewhat involved and would seem to require modification to make it conform with other technical data given in the text.

Ferranti, Ltd., have produced a new DC ampere-hour meter, type "F.K.," the main feature of which appears to be its small size. It is an excellent example of the use of "Alnico" steel magnets, only one being incorporated in this case. The construction of the mercury bath is basically the same as that of the "F.H.2." meter. An interesting feature is that the full load speed, which is approximately 18 RPM, is sufficiently low to make it possible to dispense with any compensation for fluid friction. In view of the general trend of changing over to AC, the demand for DC meters would not appear to be large, but this meter will no doubt be appreciated when the present supplies of second-hand DC meters are exhausted.

Two other Ferranti developments are the production of a two-rate meter of the "F.L." type, in which a synchronous timing element is self-contained, and a single-disc polyphase meter incorporating a maximum demand attachment with or without a self-contained timing element.

One of the developments of Sangamo Weston, Ltd., has been the application of temperature compensation to the whole of their range of AC watt-hour meters the latest patterns being the type "HMT." A notable feature of this compensation is that both the classes of error which do occur in AC watt-hour meters through temperature changes are independently compensated. Use is made of a temperature sensitive alloy, in one case to maintain the flux in the magnet gaps at a constant value and independent of temperature changes; and in the other, to counteract any effect of temperature variations on the power-factor compensation. Temperature variations in meter laboratories present a serious problem and the use of compensated meters will assist in overcoming one of the difficulties which have to be faced by meter departments.



Sangamo Weston "S2" all-enclosed and "SI" current transformers

A new range of Sangamo Weston current transformers has been produced covering Classes AM, BM and CM accuracies. They are of an all-insulated pattern, the housing being of moulded bakelite. Two types are available; model "S.2" has totally enclosed primary terminals and is insulated for 700 or 6,600 V L systems. The transformer is available in one form with wound primaries up to 300 A and in another form with bar primaries from 400 A and upwards with corresponding

(Concluded at foot of next page.)

AMERICAN ELECTRICAL SURVEY

Recovery in Output During 1939

By C. W. Kellogg (*President, Edison Electric Institute*)

THE electric light and power industry shared fully in the revival of business activity in the United States which took place during last year. Electricity output was up 12 per cent. on 1938, 7 per cent. on 1937 (the previous highest) and 38 per cent. on the boom year of 1929. For last year the total was 128,300 million kWh, compared with 114,650 million kWh in 1938, 119,810 million kWh in 1937 and 92,750 million kWh in 1929.

The year saw a serious shrinkage in water power production during the autumn months because of the progressive failure of water supply. Rainfall was deficient from the very start of the year; by September the drought became acute, and the year closed with many reservoirs empty or nearly so. Generation of elecricity by water power during the last four months of the year was 12 to 15 per cent. below that of the previous year and showed a total decline of 4 per cent. On the other hand production of electricity by steam rose to a new high level. The total for the year is estimated to have been 83,600 million kWh, an increase of 14,850 million kWh, or nearly 22 per cent., over the year before.

Analysis of Sales and Revenue

Basing the figures on ten months' actual results (with November and December estimated) sales and revenues of electricity by the light and power enterprises of the country may be approximated as in Tables I and II. Industrial power

TABLE I
Sales to Ultimate Consumers

Class	1938	1939
	Million kWh	
Domestic service ...	19,515	21,100
Small commercial .	18,316	20,000
Large (industrial) .	46,374	55,350
All other sales ...	9,689	10,550
Total ...	93,894	107,000

TABLE II
Gross Revenues

Class	1938	1939
	Million $	
Domestic service ...	825	859
Small Commercial .	609	646
Large (industrial) .	575	633
All other sales ...	163	166
Total ...	2,172	2,304

sales were nearly 20 per cent. higher than in 1938 and about 1 per cent. more than in 1937. They were nearly 25 per cent. above 1929. Commercial sales of small light and power also indicated an expansion of retail trade and showed a gain of 9 per cent. over the year before. Domestic service showed the usual annual growth. A new record was set at 21,100 million kWh, a gain of 8 per cent. over 1938. The average use per customer increased from 853 kWh in 1938 to 900 kWh in 1939. During the year considerable improvement in the sales volume of household electrical appliances took place.

The grand total of consumers at December 31st was 28,750,000, an increase of 900,000 over the number at the close of the previous year, 380,000 of the new connections were farms, making the total number of electrified farms 1,786,000, or 28 per cent. of all farms having occupied dwellings.

New construction in 1939 added 1,310,000 kW of generating capacity, of which amount 1,090,000 kW was installed by the industry and 220,000 by the Federal Government. The total generating capacity, including Government power plants, amounted to 38,600,000 kW at the end of the year. In addition, about 670,000 kW of generating plant in industrial establishments is interconnected with public supply.

New construction programmes for this year and next will add 4,315,000 kW of capacity, of which 2,830,000 kW (steam) and 70,000 kW (hydro-electric) will be provided by the industry and 1,415,000 kW (hydro-electric) by Government projects. In the industrial areas east of the Mississippi and north and east of the State of Tennessee electric utilities serving the industrial centres, which have a combined installed generating capacity of 22,385,000 kW, had reserve amounting to 39 per cent., or 6,250,000 kW, in excess of the maximum load for the year.

According to preliminary reports expenditure on construction during the current year will amount to about $600,000,000, exclusive of outlay on Federal projects; last year the amount spent was roughly $450,000,000.

TABLE III.—Output and Capacity

	1937	1938	1939
		Millions of kWh	
Generation by fuel ...	74,206	68,765	83,600
Generation by water ...	40,960	40,926	39,400
Total generation ...	115,166	109,691	123,000
Purchased energy ...	4,645	4,956	5,320
Total output ...	119,811	114,647	128,320
		Thousands of kW	
Industry capacity ...	34,960	36,330	37,466
Capacity supplying purchased energy	1,292	1,736	1,800
Total capacity ...	36,252	38,066	39,266

The length of transmission lines of 33 kV and over increased from 26,400 miles in 1917 to 89,000 miles in 1926, 120,000 miles in 1929 and 146,000 miles in 1938. This mileage provides some measure of the degree to which interconnection of electric power supply sources has advanced. In the United States, this has been a progressive development governed by economic and service conditions. As a result there are several areas in this country covered with interconnected transmission systems reasonably comparable in area with that covered by the British grid. This progressive development may be expected to continue, but the expanse of the country is so great and the consumption of power in the various industrial areas so large that in the interest both of economy and of reliability of service each area must be reasonably self-sufficient.

Lower Charges

The price of electric service was reduced again during 1939, but at a smaller rate than prevailed during previous years. It grows more and more difficult to reduce rates in the face of mounting operating costs, rising taxes and increased charges for depreciation. At the end of 1939 the average price of electricity for domestic service stood at 4.07 cents per kWh, as compared with 4.23 cents in 1938, 4.40 cents in 1937 and 6.33 cents ten years ago. The domestic consumer's average bill is now 10 cents per day as compared with 8¼ cents ten years ago, but his consumption has nearly doubled.

Due to the large increase in consumption, industrial power rates declined in average price in 1939 to the lowest point since the middle of the war emergency in 1917. Sales averaged 1.145 cents per kWh as compared with 1.389 cents in 1929.

Total revenues amounted to roughly $2,304,000,000 for 1939, an increase of $132,000,000 over 1938. Many factors combined, however, to take large bites out of this added revenue, with the result that only about $50,000,000 of it was carried through to net income. The drought made necessary the burning of much more coal and the price of coal and other materials showed some advance; taxes rose by about $20,000,000 to a figure estimated at $345,000,000, the highest on record, and represented 16.2 cents out of every dollar received from consumers; charges for depreciation were also increased. Thus, net income showed a gain of about 10 per cent. over the previous year but was still below that of 1929.

In general a gain of 18 per cent. in gross revenue during the past decade has been accompanied by a decrease in the earnings available for stockholders. Rate reductions produced a 17 per cent. drop in gross revenue per kWh during the ten years. The utilities have made strenuous efforts, through increased sales and operating economies, to offset this decrease and have succeeded in reducing the ratio of operating expenses to gross earnings from 39.3 per cent. to 37.6 per cent. The combination of operating economies, sales effort and reduced interest charges has been insufficient, however, to offset the growth in the cost of taxes and depreciation.

Electrical Instruments (*Concluded from p. 98*)

burdens for the two types of 15 and 30 VA. Model "S.1" is similar in design, but the primary terminals are not enclosed The transformers are insulated for 700 or 6,600 V L systems and have primary ratings between 300 and 2,000 A, with rated outputs of 15 and 30 VA. The transformers have ring type cores of "Mumetal" and incorporate the firm's usual combination terminal block and short circuiting device.

Chamberlain and Hookham, Ltd., have produced a useful design of polyphase meter for 100 to 200 A in which the current transformers are contained in the terminal box. This arrangement has advantages in that the winding of heavy current coils in a meter presents technical objections, and also the space required by a compact meter of this type is far less than that required by an ordinary meter together with associated transformers. The method, of course, has its limitations; but for the sizes selected, it fills a useful demand.

STRAIN CLAMPS

Erection of High-gripping-strength "Snail" Type

By A. E. L. Jervis

WITH the advent of the grid and the consequent extensive use of high strength aluminium steel core reinforced conductors, a demand arose for strain clamps having very high gripping capacities. Various types of clamps already existed, or were rapidly developed, capable of holding aluminium conductors, steel reinforced, but certain of these designs were unsuccessful because under vibration conductor breakages occurred.

The clamp dealt with in this article is one of the successful designs, and in principle it may virtually be described as a pulley groove of involute form, round which the conductor wraps, the tail passing out at the centre point. Where the conductor first enters the clamp the diameter of the groove is large, but from this point the groove is gradually reduced in size until the clamping section is reached. By this means not only is the travelling wave gradually absorbed in the conductor within the clamp, but the conductor is progressively relieved of its tension in the bed of the clamp groove as it approaches the centre of the involute where it is finally clamped.

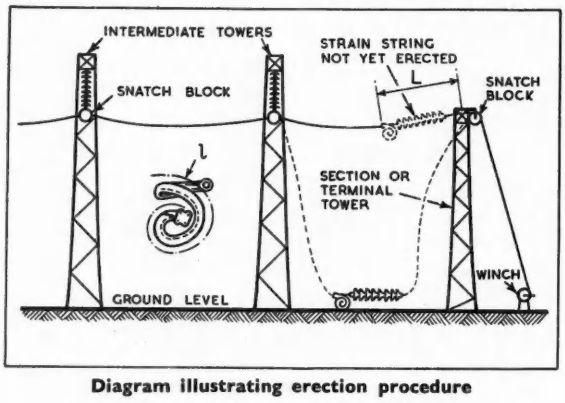
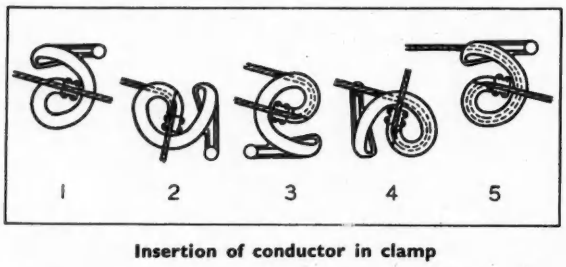


Diagram illustrating erection procedure

It is interesting to note here the fundamental difference between the "snail" clamp and the orthodox cone grip and the simple bolted plate clamps. In each of the latter designs there is a "hard spot" where the conductor ceases to be free. In the "snail" clamp this hard spot is eliminated and the life of the conductor is not impaired. The superiority of the design has been borne out time and again by tests in independent laboratories, but mention of one particular test here may be of interest.

An a.c.s.r. conductor span was stressed to 8,000 lb. tension, and vibrations of the order of 1,000 a minute and 2 in. amplitude were superimposed. Even after many days' continuous tests no signs of distress appeared on the outer strands of the conductor held by the patent high-gripping-strength "snail" type clamp. Other designs of clamps similarly tested caused ultimate fracture of some of the outer strands.

The erection diagram shows the situation immediately before the installation of the "snail" clamp. The conductor is supported by snatch blocks at suspension and tension positions and is terminated at the winch on the ground (the strain string is not yet erected). When the wire is correctly sagged and tensioned it is marked to correspond with a given point on the tower, say the centre line, and then the tension is relieved and the conductor brought down to ground level.



Insertion of conductor in clamp

A distance must now be measured, *back* along the conductor from the mark mentioned above, equal to "L," which is the overall length of the strain string from the centre line of the tower to the back of the clamp. If now a distance "1" equal to the length of clamp path be measured *forward* along the conductor, a point will be reached corresponding to the outside edge of the bolted clamp plate. This point should be recorded and the conductor, if of steel cored aluminium, should receive a single wrapping of soft aluminium tape. The size recommended is 0.300 in. wide by 0.05 in. thick with rounded edges. The length of conductor in the clamp is:—For small patent "snail" clamp K.241, 30 in. For large patent "snail" clamp K.201, 35 in.

It is customary to continue the taping for a short distance outside the clamp and so the length of taped conductor is assumed to be 4 in. longer than the above figures in each case. The diameter of the conductor has an important bearing upon the length of tape required. This point will be readily appreciated when it is known that the tape encircles the conductor approximately 114 times in the case of the small "snail" clamp and about 130 times in the case of the large clamp.

The principal conductors used are 37/.110 in. a.c.s.r. (with the patent K.201 design) and 19/.110 in. a.c.s.r. (with the patent K.241 design). When erecting the clamps with these two conductors it is necessary first of all to form a reel of aluminium tape with rounded edges, approximately 28 ft. long in the case of the K.201 design and 19 ft. approx. in the case of the K.241 design.

The conductor can now be taped for a distance of approximately 34 in. (K.241) and 39 in. (K.201) and then placed underneath the clamping plate provided at the centre of the clamp. If the clamp is rotated the taped conductor will take up its position in the clamp. The sketches 1 to 5 show the process. Alternatively, if preferred, the taped conductor can be gently pulled into position, the clamp meantime being held stationary. While the clamp is being hauled into position on the line the conductor should be tied into the clamp to avoid springing out.

Alternative Method

The method described is that actually employed on 132-kV lines, where the overall length of string is considerable, and where it is difficult for men on the tower to reach the "snail" clamp owing to its distance from the cross-arm. In my opinion this method is always preferable, irrespective of the voltage and number of insulators per string, but it is possible on short strings (33 kV for example) to vary the procedure.

In the first place the conductor can be correctly sagged over the snatch blocks and marked to indicate its final position. Taping can then be carried out without the necessity for lowering the conductor to the ground. Next, the insulator string with patent clamp is hauled up and the cross-arm attachments completed. The insulator string is now probably hanging vertically and should be swung horizontally and held to the conductor by means of a "come-along" clamp attached to the "snail" clamp. The wrapped conductor may now be pulled around the bed of the clamp and bolted by means of the plate provided at the end of the clamp.

The small K.241 clamp is provided with a two-bolt clamp plate, and the large K.201 size with a four-bolt clamp plate. To secure the conductor it is essential that the bolts be correctly tightened and in this connection it is an additional safeguard if the bolts are checked over when the clamp first takes the full erection tension of the line. In the case of 37/.110 in. a.c.s.r. this figure is 2,560 lb. at 40 deg. F., and under this load a certain amount of "settling-down" of the conductor takes place.

For this reason, during all "snail" clamp tests a settling-down load of 2,000 lb. is applied as a preliminary procedure and then, before running the load up to cause fracture of the conductor, a final bolt-tightening is carried out.

A feature of periodic tests has been the consistency of results. For example, in the case of the 37/.110 in. a.c.s.r. and 19/.110 in. a.c.s.r. conductors, one or more of the aluminium strands always fractures just below the ultimate strength, without conductor slip.

A test was recently carried out to determine the behaviour of the clamp even when the clamp bolts were not properly

(*Continued at foot of next page.*)

SWITCHGEAR MAINTENANCE

Notes for the Works Engineer

By R. T. Lythall, A.M.I.E.E.

HOW often one finds cases where switchgear is expected to work without any maintenance and where surprise is expressed that it should even be necessary! The need for maintenance of a rotating machine is appreciated, but switchgear being static should not, it is sometimes thought, require attention. Yet quite a considerable proportion of minor (and some major) switchgear breakdowns is traceable to lack of maintenance and in no way due to faulty design or manufacture. For instance, dust—accumulated perhaps over months or even years—may cause a flash-over with far-reaching consequences. It is extremely difficult, after the event, to determine the cause of such a breakdown, because more often than not the breakdown removes the evidence.

An illuminating example is quoted in "Electrical Accidents and their Causes," 1937, where Mr. Swann refers to an oil circuit-breaker which operated (often six times a day) for six years without oil in the tank until an internal flash-over occurred. It speaks well for the design of the "oil" circuit-breaker, as obviously it had had no maintenance during the period and presumably would have continued to be without attention had not some fortuitous condition caused flash-over.

In the present national emergency, with the larger output in many works, maintenance assumes even greater importance. How to lay out a switchboard in order that maintenance may be given without the need for complete shut-down has been discussed in a recent article in the ELECTRICAL REVIEW, and the purpose of the present one is to give a brief resumé of the maintenance suggested.

General Procedure

It cannot be too strongly urged that maintenance should be carried out in a methodical manner. Periods at which each item of work is to be done should be laid down and a log book relating to the work should be kept. This log would also indicate repair or other work found necessary by the maintenance staff and which could not be carried out immediately. On a sectionalised system it would be convenient to tackle sections alternately at regular intervals. Some items need attention maybe once in three months, while others can be examined, say, every twelve months. No hard and fast rule can be stated, but whatever period is agreed upon, it should be kept.

Where separate instruction books are provided by a manufacturer on particular pieces of apparatus (e.g., protective gear) they should be kept in a safe place, available at all times to the maintenance staff. Spare parts, such as fuse cartridges or wire, indicating lamps and circuit-breaker contacts, should be kept in a quantity sufficient to meet immediate needs and be replenished as used. The manufacturer may not happen to have such spares available at a minute's notice when a maintenance period expires, often at a week-end. If work is to be done on a switchboard which cannot be made completely dead, a system of permits, as employed on major networks as a matter of course, can be adopted. The use of danger cards and the locking out of feeders which can be made alive from a remote point are among the essential safety precautions.

The maintenance of a circuit-breaker may be divided into two parts, normal inspection and special inspection. Normal inspection should include examination of contacts (renewing or cleaning them where necessary), cleaning of insulators, lubrication of operating mechanism, tightening of nuts and cleaning of auxiliary switches. On the auxiliary switches may often depend the correct operation of protective gear. If some misalignment has developed, the protective gear will probably fail to function when it is most needed. Oil level should be checked and, if there is any doubt as to the electrical quality of the oil, samples should be tested as set out in B.S.148.

If contacts are trimmed up *in situ*, with the oil tank lowered beneath them, take precautions to prevent metal filings falling into the tank. Do not use "waste" but only material which will not deposit loose fibres which may line up later to cause breakdown. Merely opening a circuit-breaker (even if it is immediately closed again) is beneficial in that the natural wiping between moving contacts removes any oxide film which may have appeared.

Special inspection should be given as soon as possible after a circuit-breaker has operated under fault conditions. B.S.116 does not visualise that the breaker is necessarily in a condition to repeat that duty until it has been completely serviced. Those who have seen the condition of contacts and oil after fault clearance will appreciate this, and quite obviously it is a first essential that the breaker should be restored at once to its original condition. Otherwise it may be assumed that its breaking capacity has been reduced, and subsequent faults may not be cleared, perhaps leading to the wrecking of the breaker and other equipment.

Mr. Lythall is manager of the switchgear and transformer departments of Johnson and Phillips, Ltd.

The overhaul should include: Examination of all contacts; removal of carbon deposits on insulator surfaces; examination and, preferably, renewal of the oil; checking of all operating, tripping, and interlocking mechanisms; inspection of the tank lining for possible damage due to arcing; checking all connections, nuts for tightness, and tank to top plate joint; and seeing that all tools used have been removed before putting the breaker back into service.

Isolating switches are not, except by accident, called upon to open load current. Nevertheless, a degree of maintenance is very desirable, comprising contact check, cleaning of insulators, tightening up connections, and greasing or oiling of operating mechanism.

Protective gear must be checked in order to be sure that in time of need it will function as expected. Relay contacts should be examined to ensure that they really are making good contact. If possible, test current should be applied to coils and the protective system tried out in a manner which would arise in the event of a fault. Connections should be examined for continuity and tightness at points of connection. Where special instructions are issued for a particular system, these should be faithfully followed. Time-limit fuses have been known to deteriorate and should be examined to see that any replacements have been carried out correctly.

Even in a cubicle with very close-fitting doors, dust will collect after a time, and, if allowed to accumulate, may be the cause of breakdown. Dust is a danger not only on high-voltage equipment, but also on details such as terminal boards and between adjacent terminals of relays and instruments.

The real preventive of damp is a properly situated and ventilated switch room. Damp may particularly affect wiring and connections, causing corrosion leading to bad contact. Freedom from damp is preferable to attempts to check its effects, but if it is present frequent maintenance is essential.

A general check of instrument transformers is necessary to ensure that connections, both main and secondary, are in good condition and that joints are maintained tight. While cleaning insulators, cracks or other damage should be looked for and rectified at once. The level and condition of oil in voltage transformers is as important as it is in oil circuit-breakers. Fuses protecting voltage transformers should be checked for continuity and general soundness.

The type of tripping battery which allows installation of trickle-charge equipment is recommended, the equipment including suitable instruments to enable a daily check to be made on the condition of the battery.

Strain Clamps (*Continued from preceding page*) tightened, the conductor employed being 7/.144 in. steel. At a load of 8,300 lb. a slight slip occurred in one clamp. The load was steadily increased, causing the conductor to slip still further but at a slower rate, until the conductor broke at its ultimate strength of 19,200 lb. This is a remarkable testimony to the gripping efficiency of the "snail" clamp.

Further tests were recently carried out to check the strength of the eye attachments for taking the come-along clamps. In the case of the small "snail" K.241 the eyelet broke at 12,000 lb., and in the case of the large clamp K.201 the eyelet broke at 18,000 lb. When it is known that the erection load is, for example, only 2,560 lb. in the case of the large clamp it will be appreciated how high is the erection factor of safety.

INSTITUTION PROCEEDINGS

Thomas Hawksley Lecture. H.P. and Forced-control Boilers. Storage Batteries

Rural High-voltage Distribution

THE possibilities of high-voltage distribution in rural areas were reviewed in a general way in a paper by Mr. K. L. May (Edmundsons' Electricity Corporation, Ltd.), which was presented last week at Belfast before the Northern Ireland Sub-Centre of the Institution of Electrical Engineers.

The author endeavoured to concentrate upon essential factors in design, construction and economics, giving the minimum of attention to purely technical points. Graphs, tables and line design sketches were included which should be of practical value to both distribution and constructional engineers.

The paper explored in detail the advantages offered by, and the steps it is necessary to take in order to obtain the full benefit of, the modifications of the Overhead Lines Regulations covered by the Electricity Commissioners' circular letter No. 2854 of September 24th, 1937, as well as the Post Office Regulations, Form E-in-C 229 of November, 1938.

The conclusions reached were that from each of the theoretical, practical and financial standpoints copper lines appeared to be more favourable when compared with steel conductors.

The possibilities of rural development which might be opened up by the use of combined high- and low-voltage lines carried on the same poles were surveyed, and a warning uttered that the initial cost of a combined scheme, even after allowing for smaller low-voltage conductors, would often not be less than for a standard low-voltage scheme.

Generally, where a single-phase combined scheme could be employed instead of a three-phase low-voltage network the cost would be lower than for three-phase, but when three-phase high-voltage was necessary for a new or initial scheme there was sometimes little difference in cost. In cases such as the latter the greater scope of combination on the same poles should be borne in mind, and also the fact that subsequent additions and extensions to the network could be carried out more readily and at less cost, particularly as this could often be done without changing the existing transformer.

The elimination of steel conductors from high-voltage lines in favour of copper, except in particularly special cases, and the successful development of combined networks, were factors which would, in the near future if not immediately, remove to some extent the difficulties and restrictions which in the past had proved a handicap to the full development of load in rural areas.

Power Station Practice

FORTY years' development in mechanical engineering plant for electric power stations was reviewed by Sir Leonard Pearce (engineer-in-chief, London Power Co., Ltd.) in the twenty-sixth Thomas Hawksley Lecture, which has been delivered before the Institution of Mechanical Engineers in London and at provincial centres.

Sir Leonard's association with the electricity supply industry dates back to 1897 and although the first part of his lecture was not intended to be autobiographical, it gave an account of the progressive design and equipment of those stations with which he has been intimately associated.

The lecture commenced with brief references to early Parsons turbo-alternators and the development of reciprocating engines for electricity generation. Then the growth of the Manchester Corporation stations was outlined, followed by those of the London Power Co. at Deptford and Battersea. The company was constituted in 1925 to act as the generating authority for ten (now nine) London electricity supply companies, and it had wide powers to give supplies in bulk and to railway authorities. Its policy had been to close the smaller and less efficient stations, to improve and extend others, to erect new capital stations containing sets of large capacity, to provide a 66-kV primary transmission system interconnecting its power stations and a 22-kV secondary distributing system.

It was significant that in the short space of ten years the Deptford (West) station, planned originally for 25,000 kW turbines and 95,000 lb. per hour boilers, should have as its latest additions a turbine of 100 per cent. and a boiler of 270 per cent. greater capacity arranged in the space which was originally allocated for the smaller sets.

The present designs of the Battersea "B" station envisaged completion by the installation of three 100,000-kW combinations, the order for the first having been placed in 1937. Each of these sets would have two boilers, each boiler having a maximum continuous rating of 550,000 lb. of steam per hour. One of the main factors was that when generating between the normal economic and maximum continuous ratings, the two boilers together would only have to operate at about their most economic load, so that greater availability might be expected. At the same time, in an emergency one boiler only in service would be able to carry 65 per cent. of the M.C.R. rating of the turbine. Throughout the initial stages of design the objective was greater availability comparable with that realised with turbines, and for this purpose the combustion chambers were designed of such size as to give a low heat release value.

The conclusion drawn from the retrospective first portion of the lecture was that concentration of production, so far as was reasonably possible, in a few well-selected and interconnected stations was a sound policy. The second part of the lecture dealt more generally with some of the fundamental factors that had influenced the progress represented by the examples referred to the first part.

At present steam plant was being constructed for two stations to operate at 1,400 lb. per sq. in. and 950 deg. F. with feed heating to 400 deg. F. and it seemed probable that conditions of this order might become stabilised. These figures all related to the straight regenerative cycle, for which the majority of plants in this country had been designed. While thought in this country was directed towards increasing temperatures, it was towards higher pressures that developments were taking place in the U.S.A. The highest pressure so far projected appeared to be 2,400 lb. per sq. in. at 940 deg. F. for the Twin Branch station of the American Gas & Light Co., operating on a reheat cycle to avoid excessive moisture at the very high initial pressure.

Higher Steam Temperatures

Sir Leonard thought it was not beyond the bounds of probability that steam temperatures of the order of 1,000 deg. F. would eventually be adopted, but he did not consider that very much was to be gained by exceeding an operating pressure of 1,500 lb. per sq. in.

Various methods had been proposed for projecting the thermal efficiency of a station in such a way as to enable appropriate steam conditions to be considered. Sir Leonard added, in an appendix to his lecture, a method of calculating efficiencies and heat rates which had been used by the London Power Co. for many years. It had proved to be very reliable and gave strictly comparable results, being based on the examination of many hundreds of actual operating results and therefore practical in its application.

The choice of the heat cycle was peculiar to every station. For the present, "superimposition" was not likely to become popular on this side of the Atlantic. Actual results obtained from a large number of representative stations illustrated the effect on efficiency of increasing steam temperatures and pressures. But for the economies effected in coal burned per kWh output, increased production costs would have been inevitable.

The lecturer indicated how considerably station layouts had changed, both in respect of capacity accommodated on a given site and of the relative disposition of components. The main trend appeared to be towards building more stations of limited size, say, 250,000 kW; in other words, decentralisation. Also, there was a move towards the separation of switch houses from the main power station buildings, when practicable, and the division of component parts into separate sections, so that damage to any one part might have the minimum effect on the remainder.

While *force majeure* was responsible for this trend, Sir Leonard was convinced that from considerations of efficiency, and capital and running costs, it would prevent the steady decrease of cost of generation which would obtain if present normal practice were allowed to proceed. It was begging the question to claim that multiplicity of smaller stations could be as efficient as larger base load stations simply because individual plant component efficiencies could be as good.

Tabulated data of large turbo-alternators in service indicated size preferences, Sir Leonard remarking that there was a definite limit to the use of 75,000 and 100,000 kW sets in large base-load stations in this country, though there was a leaning towards somewhat larger sizes in America.

There were at present in service or under construction in this country not fewer than eighty machines of 25,000 kW or more at 3,000 RPM, the main advantage of high speed being saving of weight and space. The Battersea "B" 11-kV machines would each consist of a 16,000-kW primary set operating at 1,350 lb. per sq. in. and 950 deg. F. at 3,000 RPM, together with an 84,000-kW secondary set using steam at

600 lb. per sq. in., its size precluding a speed higher than 1,500 RPM. They would have 12 and 43 stages, respectively producing 41.4 kW per sq. ft. of floor area and weighing 14.5 lb. per kW.

Details of large boilers showed how design had been revolutionised to the extent that the "boiler," as such, was a gradually decreasing proportion of the whole, in some cases being little more than a screen of widely pitched tubes instead of several deep banks as was formerly common. Increased evaporative capacity had been accompanied in all types by a reduction of space occupied, due to better appreciation of heat transfer and combustion factors. It was arguable whether in stations operating at high load factors efficiencies at least comparable with those obtainable under automatic control could not be equally well secured with manual control.

The advantages claimed for forced circulation, some of which had still to be proved, must be offset against greater complication by the inclusion of pumping equipment, which absorbed power continuously and needed elaborate protective devices and controls. Tabulated details were included of 15 La Mont, five Sulzer, four Loeffler, and one Velox boilers installed or on order in Great Britain.

All stokers at the Deptford (West) and Battersea stations were of the retort type, and it was worthy of note that at the latter station the actual running boiler efficiency for years had been over 88 per cent., based on the gross calorific value of the fuel.

The lecture was well illustrated, including tabulated and graphical information. Much of the data it contained had been specially collected and had not appeared in the same form elsewhere. The two main lessons to be learned from Sir Leonard's survey were the importance of avoiding set ideas and the value of breadth of view.

Specialised Boilers

AT a recent well-attended meeting of the London Technical Group of the Electrical Power Engineers' Association at Westminster, Dr. R. Pendennis Wallis reviewed high-pressure and forced circulation boilers, remarking that the scope and usefulness of specialised boilers developed during the last ten years or so to meet the requirements of particular needs must of necessity be restricted. He illustrated the Babcock & Wilcox high-head natural circulation boiler and discussed some of the principles and details of the Benson, Ramzin, Sulzer "Monotube," La Mont, Loeffler, Schmidt-Hartmann and "Velox" boilers.

As the result of several years of operating experience Siemens-Schuckert had concluded that the Benson boiler could be operated successfully below the critical pressure (3,200 lb. per sq. in.) and thus reduce the feed pump power. That somewhat changed the operating cycle, for at subcritical pressures in a portion of the circuit latent heat would be added and ebullition could take place. The tubes in that portion would be subjected to indeterminate rates of heat transfer, since at one moment they might be drowned in water and the next moment they might be immersed in steam. That difficulty was overcome by placing the conversion zone in the later gas passes where the temperature of the products of combustion was not high enough to cause serious overheating of the tubes. In the Ramzin boiler (which was developed in Russia and was very similar to the Benson boiler operated at sub-critical pressure) that difficulty had not appeared.

Back pressure or pass-out process steam, being irrecoverable, boiler make-up might range from 50 to 100 per cent. The cost of distilling that large make-up was too great, and the boiler must be fed with chemically-treated water containing a definite amount of salts. Under those conditions the boiler acted as a concentrating pan, but internal tube cleaning could be performed without stopping the boiler each of the six or eight parallel paths was isolated in turn and flushed with clean hot water, which dissolved the deposit.

The outstanding feature of the Sulzer "Monotube" boiler was that at the stage when the fluid consisted of 95 per cent. steam and 5 per cent. moisture the salts concentrated in the remaining water could be withdrawn from the circuit by means of a "spillover" or "salt interceptor," arranged to work continuously or intermittently, the loss of water being made up by injecting a corresponding amount of softened make-up.

By means of a diagram the author showed the probable variation of temperature and stress in tube metals. Various alloy steels presented advantages from the point of view of creep, but they might be offset by a lower thermal conductivity.

The small head of water above the evaporator coils and the absence of riser tube outlets rendered evaporation in the Schmidt-Hartmann boiler remarkably quiet and steady, and the amount of moisture carried over with the steam was extremely small. Since the maximum temperature in the evaporator drum was the saturation temperature of the primary system, it was not so necessary that the feed water should be absolutely pure, in fact, in emergency such a boiler could be fed with ordinary sea water and in that respect it was in no way inferior to the Scotch marine boiler. It was particularly suitable for industrial process work, where little or no condensate was returned to the boiler.

The "Velox" boiler was described as the most revolutionary of all the new designs and, after discussing the application of the gas turbine to steam generation, the author concluded that the main advantage of the forced circulation boiler was in its increased output for a given space and weight of material used in its construction. Each of the various types had its particular sphere of usefulness, and it was unlikely that any one type would meet the needs of all branches of industry.

Discussion

Mr. R. E. Trevithick said that, apart from small flash boilers and those on vehicles, there were more than a thousand forced circulation boilers of various kinds in the world, chiefly in Europe; they represented an hourly evaporation of 7,500-8,000 tons of water. Was it not the fact that the working of the Benson boiler at the critical pressure of 3,200 lb. per sq. in. had been abandoned, so that it could now be called a normal pressure boiler? The Sulzer "Monotube" boiler tube some 30,000 diameters long (half a mile) must offer a very high resistance to the feed pump.

Mr. J. Calderwood said that the loss due to feed pump power in the Sulzer "Monotube" boiler was just about the same as the loss (or power absorbed) due to the nozzle in the La Mont boiler, being roughly ½ per cent. of the boiler output. The long-tube resistance was reduced to a reasonable figure by the Sulzer type joint with a streamlined surface, without weld metal protruding into the tube. For delivering processing steam, all these types of boilers could be made equally suitable.

Dr. Pendennis Wallis recalled that at the works of Siemens-Schuckert in 1930 he had seen boilers controlled very well thermostatically, the load being raised and lowered by pressing buttons. Generally temperature regulation was very much more suitable than pressure regulation.

Mr. S. Macewan said that in this country there were fewer high pressure boilers than there ought to be. The international situation caused a tendency to revert to standardised practice and to avoid risk. Such advantage as small space occupied was undoubtedly important, but the major gain was higher overall station efficiency. The operation of a Benson boiler by push-button control, from a table resembling the keyboard of an organ, had been demonstrated to him. The load was increased and decreased at will, the steam temperature remaining constant, and the control was perfect. With a Loeffler boiler one could maintain the superheat temperature, which was the important factor, constant at all loads by varying the steam circulating pump; full speed could be maintained perfectly at any load. At Brimsdown the auxiliaries were controlled on the Ward-Leonard system.

Mr. L. M. Jockel said that he had never found any data concerning the maintenance of any of the new types of boilers, excluding the first two years.

Dr. Pendennis Wallis, replying to a question by Mr. Jockel concerning the difference between gross and net thermal efficiencies, emphasised that one could add economiser and air heater surface beyond the commercial limit, so that, although the thermal efficiency might be high, it did not follow that the energy generated would be cheaper.

Advantage of Forced Circulation

Mr. G. A. Plummer said that forced circulation had many advantages which were not immediately apparent. It enabled small diameter tubes to be used, they could be arranged in any form to suit the space available and in the most favourable position from the heat transfer point of view, without worry over improper circulation; smaller and fewer drums were required. All those advantages meant a smaller and more compact boiler. The La Mont type had rapidly achieved an enviable reputation; it made provision for water storage, but could be blown down just like a normal boiler. Unlike many designs mentioned, it was not restricted to the use of any particular fuel, or service, or size. Some were under construction in this country to operate at 1,400 lb. per sq. in. and 960 deg. F. final temperature. The power taken by the circulating pumps was 0.5 to 0.7 per cent. of the boiler output, part of which was returned to the boiler in the form of heat, and in the majority of cases was more than counterbalanced by the saving in mechanical draught plant. He showed in graphical form readings from a 1,000 lb. per sq. in. La Mont steam generator operating under exceptionally variable load conditions.

The output had been varied in one minute from 8,000 to 40,000 lb. of steam per hour, the variation in water level being less than ¾-in., while the steam temperature did not vary more than 15 deg. F. The largest La Mont generator in the world was capable of developing 350,000 lb. per hour; the weight of steam generated per hour per sq. ft. of available floor space was 235.7 lb.; per cu. ft. of boiler space occupied it was 9.75 lb. The unit occupied the same space as a natural circulation boiler of less than one-third its capacity.

Mr. E. F. Hall suggested that the "Velox" and similar types were suitable only for oil fuel; blowing down effectively at high loads seemed to him extremely difficult.

Mr. Plummer said that in the La Mont boiler the ability to blow-down had nothing to do with the load, because the rate of circulation remained more or less constant.

Storage Battery Applications

SOME of the very many applications of storage batteries of the lead-acid type are reviewed in a paper by Mr. E. C. McKinnon (chief engineer, Chloride Electrical Storage Co., Ltd.) which has been issued by the Institution of Electrical Engineers and is to be presented at the North-Western Centre at Manchester on February 20th.

The author deals in some detail with purposes, latest improvements and practice, and actual results obtained in service in electricity supply undertakings, on consumers' premises and in public buildings, mostly for emergency and A.R.P. purposes, for communications and marine, mining and railway applications, as well as to road vehicles of differing kinds.

About half a million mechanically propelled commercial goods vehicles are on the roads in this country. Probably 60 per cent. operate only in urban areas. Of these 300,000 vehicles not more than 4,000 are battery propelled, although battery electric vehicles represent the cheapest form of mechanical road transport, carrying pay-loads at ½d. per ton mile. The old objection that they were too slow has been disposed of—actually under urban delivery conditions they are quicker than petrol-engined vehicles with normally twice the maximum speed of the electric.

Although expansion in battery-propelled vehicle business in this country has been appreciable in recent years, the rate of development is still very slow compared with that in, say, Germany. There the national policy under the four-year-plan of restricting imports, especially if alternative home resources are available, has led to a great increase in the use of battery-propelled vehicles (including barges and locomotives).

The reliability, high efficiency and durability of modern vehicle batteries are indisputable, and the cost of maintenance compares favourably with that of, say, horse-driven and, for short-radius work, petrol-driven vehicles. Some attention has been given to the practicability of electricity supply undertakings hiring out batteries for electric vehicles. The scheme has enthusiastic protagonists, but has not reached fruition.

Different makers have adopted different policies regarding their main design of traction battery, some aiming at robustness and durability as being the two prime essentials for the great bulk of present-day commercial traction work while others concentrate on light traction batteries for a given capacity. The two conditions are not compatible. It seems obvious that battery makers will have to continue as heretofore to cater for these two absolutely distinct sets of conditions.

The cells can be charged at very high rates, making it possible to replace about 80 per cent. of the rated capacity in a period of, say, three hours, if it is considered worth while to put in the heavy charging plant necessary. In practice, however, in nearly all cases there is actually ample time to carry out charging at more ordinary rates, and the extra trouble and expense involved for specially rapid charging appears quite unjustified.

Occasional trouble with burnt-out motors can be traced to one of three causes: (1) The use of a motor with inadequate margin of safety and with poor efficiency at low speeds. (2) Over-gearing, especially in hilly districts, resulting in low speeds on hills. (3) Insufficient battery capacity, especially if the battery be sluggish.

Trolley-bus Manoeuvring

The application of storage batteries to trolley-bus manœuvring has developed rapidly during the past three years. Although the Ministry of Transport has increased the unladen-weight allowance of trolley-buses fitted with batteries for manœuvring, battery manufacturers are still limited to a weight allowance of 400 lb. (maximum), because transport managers have taken advantage of the extra weight allowed to increase the seating capacity. Apart from recuperative property, the lead-acid battery has the advantage that, even when exhausted as regards propulsion ability, it will still at low discharge rates maintain the statutory lighting for some hours.

The standardisation of trolley-bus batteries is still incomplete. Actual results suggest that the best compromise in battery voltage is 60 V for propulsion and 30 V for lighting, using a series-parallel switch—a method which is giving satisfactory results in practice. But lighting standardisation is in suspense as controversy has arisen over the question of series-parallel versus three-wire battery circuits, and also whether the standard voltage for Diesel-engine starting batteries on commercial vehicles shall be 12 or 24 V.

The Norwich Appointment

AS we have already reported, the Norwich City Council recently advertised for a successor to Mr. V. A. Pask as city electrical engineer at a salary of £1,500 per annum, rising by two annual increments to £1,700. The A.M.E.E.-E.P.E.A. Joint Committee requested members of the two associations not to apply for the post on the ground that the salary should commence at £1,700. In spite of this the Council instructed the Electricity Committee to proceed with the appointment of an engineer at the advertised salary.

The matter was disussed again at last week's meeting of the City Council when the General Purposes Committee asked the Council to withdraw from membership of the No. 8 District Joint Committee of Local Authorities and Chief Electrical Engineers. In moving the resolution, the Lord Mayor mentioned that the proposal to set up an organisation to deal solely with the salaries of chief electrical engineers was made just over a year ago. So far there had been only preliminary discussion and no salary scale or basis of remuneration had been agreed. Nevertheless, the chief electrical engineers had presented the Council with an "ultimatum" as to the conditions under which the Norwich vacancy should be filled. In these circumstances, with menaces substituted for negotiation, he could only recommend withdrawal from the Joint Committee.

The seconder of the resolution (Mr. H. Frazer) maintained that the chief electrical engineers were endeavouring to "sabotage" the great effort which Norwich was making in time of war. He believed that had such action been taken by the manual workers or the technical or administrative staffs a higher authority would have stepped in.

Mr. H. Deacon, who opposed the motion, said that nobody should grumble at paying a salary of £1,700 to a man in charge of an undertaking with a turnover of £500,000. He maintained that the chief engineers were as much entitled to have their "trade union" as other workers.

Mr. P. E. Curl, supported the resolution, but proposed that the Electricity Committee should be permitted to offer a salary sufficient to attract the right man. It should not be bound by the salary figure proposed. The Lord Mayor ruled the amendment out of order as introducing a new proposal into the resolution.

Mr. S. A. Bailey, chairman of the Electricity Committee, said that only about 40 per cent. of municipal undertakings were associated with the Joint Committee. Some years ago it had been proposed to adopt the Walker Scale of salaries, but the proposal had been rejected on the ground that the Council was not prepared to allow its electrical engineer to become the highest paid official in its service. On the basis of output the salary would start at £2,000 a year. To pay this would put the Council into difficulties with other officials.

Mr. J. H. Brooksbank, the Council's representative on the No. 8 Joint Committee, said that there was no argument against payment upon output. It was because of the arbitrary attitude of the chief engineers that he supported the resolution.

The resolution was carried by 28 votes to 11.

We report in our "Personal" section that Mr. J. A. Sumner, of Derby, has been recommended for the appointment.

The Paris Fair

THE Foire de Paris will be held as usual this year from May 11th to 27th at the Porte de Versailles. The inventions competition will again be held. Last year 769 inventions were submitted by 517 competitors, representing fifteen countries. Those wishing to compete should send in the application form (obtainable from the London Office of the Fair, 17, Tothill Street, S.W.1) not later than March 31st.

PERSONAL AND SOCIAL

Information regarding new appointments and other matters of interest for this page are welcomed

TO mark his departure from Norwich to take up the appointment of manager of the Mid-East England Area of the Central Electricity Board **Mr. V. A. Pask,** city electrical engineer, was presented with a gold hunter watch and some cut glass at a social evening held at St. Andrew's Hall by the works and sports committees of the Norwich Electricity Department. The football section presented him with a pocket lighter, and the chief constable, Mr. J. H. Dain, handed him a gold fob chain on behalf of the committee of the Norwich Lads' Club, of which Mr. Pask has been hon. treasurer since 1932.

Mr. J. A. Sumner, deputy borough electrical engineer of Derby, has been recommended for the position of city electrical engineer of Norwich by the Electricity Committee, in succession to Mr. Pask.

Mr. W. F. Hindes, who has held the position of wayleaves officer to the Colchester Corporation Electricity Department for the past eleven years, is retiring at the end of this month.

Social functions these days are few, but the Besco Social Club, which is composed of staff members of the Boston and District Electric Supply Co., is still carrying on, and on January 12th it held its annual dinner at the White Hart

The Dowager Lady Swaythling inspecting the new electro-steam cooking range at the display of electrical apparatus for wartime use at the E.A.W. headquarters (see page 109)

Hotel, Boston, **Mr. A. W. Pratt** presiding. The toast of "The Club and Company" was proposed by Councillor A. C. Rysdale, and Mr. Pratt responded. Mr. H. Payn, A.M.I.E.E., president of the club, proposed the toast of "Our Guests," and Mr. H. G. Frost replied.

Sir John Reith, who was recently appointed Minister of Information, has been adopted as National Parliamentary candidate for Southampton.

Sir Andrew Duncan, the new President of the Board of Trade, is to be invited to accept nomination as candidate for one of the Parliamentary seats for the City of London.

Major R. H. Rawll, M.I.Mech.E., M.I.E.E., who, since the outbreak of hostilities has been on military service in command of an anti-aircraft battery, Royal Artillery, has now resumed his duties as sales and development engineer with the City of Birmingham Electric Supply Department.

Mr. A. Rowell, installation inspector with the Battersea Borough Council Electricity Department, who recently retired, has been presented with an electric chiming clock and a box of cigars by his colleagues of the Electricity Department and vases and ornamental flowers by members of the Borough Officers' Club. The presentations were made by Mr. F. J. Thompson, the borough electrical engineer and manager.

Mr. C. L. Holman, district engineer and manager with the Wessex Electricity Co., has been presented with a mahogany writing desk upon his retirement after forty-five years' service. For the past fourteen years Mr. Holman has been at Frome.

Mr. G. H. Light, of the Chloride Electrical Storage Co., Ltd., who was recently married to Miss R. G. Churches, has been presented by the company with an oak and chromium kerb and firescreen.

Mr. K. E. Garcke has been appointed a director of the Antrim Electricity Supply Co. and the Antrim Electricity Distribution Co., Ltd. He is now on the boards of all the subsidiary companies of the B.E.T. Electricity Supply Co., Ltd.

Mr. G. Thomson, assistant (electrical) in the Chief Mechanical Engineer's and Electrical Engineer's Department, Glasgow, of the London, Midland & Scottish Railway, has been appointed outdoor machinery and electrical assistant.

Mr. E. J. Baker has been elected a director of Robert Hornby & Co., Ltd. Mr. Baker is also a director of Siemens-Schuckert (Great Britain), Ltd., and is in charge of the latter company's telephone, meters and industrial X-ray departments.

Mr. H. E. Harden has been elected director of Erinoid, Ltd.

Mr. R. Turner Hood, formerly chief Scottish sales representative for British Timken, Ltd., has now been appointed chief of the mechanical engineering department of this company.

At the annual meeting of the St. Maurice Power Corporation in Montreal, **Mr. J. B. Challies** was elected to the board of directors to fill the vacancy caused by the death of Mr. Julian C. Smith. At a subsequent meeting of the directors the following officers were appointed: President, Mr. J. Wilson; vice-president, Mr. O. B. Brown; treasurer, Mr. W. S. Hart; secretary and vice-president, Mr. J. B. Challies; and vice-president, Mr. W. Brown.

It is the custom of the Electrical Power Engineers' Association to make a presentation to its immediate past-president at the "Southern" dinner of the Association. As last year's dinner had to be cancelled, the presentation to **Mr. L. Hoskison** was made at the December meeting of the National Investigation Committee. It took the form of a radiogram, with an easy chair for Mrs. Hoskison.

Bailie J. Brown, Motherwell, who was recently appointed to the chairmanship of the Scottish District Joint Board for the Electricity Supply Industry, has now been appointed chairman of the Scottish Joint Board, which controls conditions and salaries of the technical staffs for electrical supply in Scotland. Bailie Brown is convener of the Electricity Committee of Motherwell and Wishaw Town Council.

Obituary

Mr. A. E. Banks, formerly sectional engineer at Leicester G.P.O., died at his home at Blaby on January 16th. He entered the service as a sorting clerk and telegraphist at Halifax, in 1898, was transferred in 1911 to the engineering department as a probationary sub-engineer at Manchester, and in 1914 was promoted to assistant engineer. He went to Leicester in 1929, and retired last year owing to ill-health. Mr. Banks was a member of the Post Office Advisory Committee, an Associate Member of the I.E.E., a member of the Council of the Institute of Post Office Electrical Engineers, and was a lecturer at Leicester Municipal College from 1930-38, and at Manchester Technical College.

Mr. W. B. Smith.—The death is announced of Mr. William Blair Smith, electrical engineer, who for a number of years acted as assistant to the late Mr. J. A. Robertson in Greenock Corporation Electricity Department. Mr. Smith was subsequently appointed electrical engineer to the Paisley Corporation, and relinquished that position in 1932 owing to ill health. He had latterly been with the Clyde Valley Electrical Power Co.

Mr. B. Street.—The death occurred on January 19th of Mr. Bernard Street, who for nearly thirty years was manager of the Normanton factory of the Yorkshire Electric Detonator Co., of which he was also a director. He was fifty-six years of age.

Mr. John Senior, who was electrical engineer of Ilkley for ten years until his retirement about fourteen years ago, died at Mirfield on January 16th, at the age of seventy-four. Mr. Senior had also been electrical engineer at Mexborough. The funeral took place at Kirkheaton Cemetery on January 19th.

Mr. P. J. Whiting, founder and director of Taylor, Whiting & Taylor, electrical contractors, of Nottingham, died on January 12th, at the age of seventy-four. Mr. Whiting had been chairman of the local branch of the Electrical Contractors' Association for twenty-five years.

Mr. H. L. Doherty.—The death has occurred in Philadelphia at the age of sixty-nine of Mr. Henry Latham Doherty, founder and president of the Cities Service Company, the parent concern of nearly 200 oil, traction, light, and gas and electric power companies throughout the United States. His scientific achievements won for him in 1930 the Walton Clark medal of the Franklin Institute and he was the patentee of more than 150 inventions.

Dr. Ing. D. Salmoiraghi.—The recent death is reported from Rome, at the age of 69 years, of Dr. Ing. Darvino Salmoiraghi, one of the best-known hydro-electric engineers in Italy.

Mr. John James Jackson McGeoch, of Giffnock, whose recent death is announced, was for many years associated with William McGeoch & Co., Ltd., electrical suppliers and manufacturers, of Glasgow, being the last surviving son of the founder of the business. He retired from commercial life some years ago.

Correspondence

Every letter must be accompanied by the writer's name and address preferably, but not necessarily, for publication. The Editors cannot accept responsibility for correspondents' opinions

"Nobody's Babies"

ACCORDING to the letter from Mr. Banks published in your issue of January 19th, the Stretford and District Electricity Board has been a member of the National Board and the National Council for twenty-one years, and during that period has carried out the recommendations of those two bodies, including, I assume, recommendations affecting the installation inspectors. Further wage packets I have received show weekly amounts as low as £3 1s. 3d. net, payments made under this machinery to the installation inspectors for inspecting and approving installation work carried out by contractors. Surely there is no need for further comment except, perhaps, to express surprise that such inadequate remuneration should be approved by the responsible parties.

With regard to the general question, the fact that employers have not sought to restrict the choice of organisation by the employees does not affect the issue. What does affect it is the decision, as stated by Mr. Banks, that the organisation chosen by the employees can only negotiate if it is, or is willing to be, a member of the National Council or the National Board. This can only mean that the employees must be members of an organisation which is, or is willing to be, a member of the two bodies mentioned. That in itself is a restriction not compatible with "freedom of choice of organisation." If twenty-one years' participation in the machinery referred to gives rates of pay such as I have mentioned, then the prospect is not very encouraging.

While I do not desire to prolong this correspondence, good may come from the exchange of views. In fact, a suggestion has been made to me that there may be a case for the formation of a national body to deal with the technical and practical staff employed on the distribution and installation side of the industry, as distinct from the supply side. My Association has under consideration the calling of a national conference representative of the membership concerned, and such a conference may lead the way to a solution of the present difficulties.

In the meantime, may I express the hope that the Stretford and District Electricity Board will uphold the good name of the industry by giving its installation inspectors adequate conditions of employment.

A. BRAMMER,
General Secretary,
Association of Supervising Electrical Engineers.

London, W.C.2, *January 22nd.*

Parliamentary News

Street Lighting

IN the House of Commons on January 18th Mr. Burke asked the Home Secretary why local authorities who were desirous of instituting a modified form of street lighting, and who had purchased lamp fittings made according to the Government standards, were prevented from using these lamps; and when could makers of such lamps expect to receive British Standards Institution certification marks.

Sir John Anderson said that he had not heard of any such difficulty. The British Standards Institution informed him that every maker who had applied for a licence to mark fittings for the new form of street lighting had already been granted a licence.

Torch Batteries

In reply to questions regarding the supply of torch batteries, Major G. Lloyd George said he was not satisfied that any radical alteration in the existing methods of production and distribution of batteries for hand torches would result in an increase in supplies. The Board of Trade was continually in consultation with the manufacturers with a view to ensuring that everything possible was done to meet the demand. The production of torches and batteries in this country was, at present, concentrated on a few standard sizes and that plant for the manufacture of batteries for small torches had been increased since the outbreak of war. Batteries and torches of all sizes had been included in the first Order made under the Prices of Goods Act, and it was now open to members of the public to ask their Local Price Regulation Committees to investigate any increases of price which appeared to them to be unreasonable.

He was aware that in certain districts there was still a serious shortage. It was partly due to the moving population and, secondly, to the fact that the demand was wholly without precedent in this country. Indeed, in the first six weeks of this war more torches were bought than in the whole of the last war. The supply was much better and the output had increased by over 100 per cent. since the new plant had been erected.

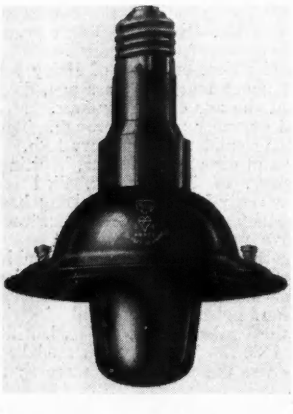
Cheap Telephone Calls

Captain Waterhouse, the Assistant Postmaster-General, announced that February 12th would be the date on which the 1s. trunk telephone calls after 7 p.m. would come into operation. To relieve congestion, it had been decided that the concession should operate for calls from call-boxes from 6.30 p.m.

Approved Street Lighting Fittings

SEVERAL manufacturers have now been informed by the British Standards Institution that one or more of their units for the modified street lighting have satisfactorily passed the required tests.

The Revo A.R.P. street-lighting fitting has been evolved after exhaustive experiment and test during which has been developed a new technique for the creation and production of the optical system required to maintain permanent adherence to the fine limits and critical tolerances necessary for the extremely low intensities that are now permitted.



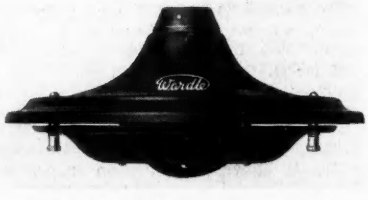
Revo unit for restricted street lighting

The unit is constructed of three members, two of which are rigidly assembled together to form the optical system and which in itself is designed to withstand the rigours of exposure to adverse elements and unskilled maintenance without disturbance of the light output. Reassembly after changing a lamp has no effect on light output owing to the precision with which the parts are made.

The vitreous enamelled surfaces provide permanent reflection and minimise cleaning and maintenance. Simplicity of installation is outstanding feature; adaptors connected to the unit and suitable for g.e.s., e.s. and b.c. lampholders are provided, and special adaptors and brackets can be supplied for economically converting existing sodium and mercury lighting units.

The B.S.I. licence was first granted for the unit for 20 ft. mounting height with a 15-W pearl lamp, but subsequently approval has been received for the fittings for 15 ft. and 10 ft. The complete series covering all mounting heights as in BS/ARP 37 is now in production and deliveries will commence almost immediately.

The Wardle Engineering Co., Ltd., states that it has received a licence and can give immediate delivery of the units for 20 ft. mounting for use with 25-W lamps. Units for 15 ft. mounting with 25-W lamps and for 10 ft. mounting with 15-W lamps are in course of preparation.



Wardle No. 931 bracket type lantern

Two types of fitting are available, namely, the adaptor type for attachment to g.e.s., e.s., or b.c. lampholders, and the bracket type, complete with b.c. holder.

Besides the licence for its 60-W unit for 20 ft. mounting mentioned last week the General Electric Co., Ltd., has now obtained approval of its 40-W, 15 ft. mounting fitting. These units were described in our issue of January 5th.

Holophane, Ltd., has received the B.S.I. certificate for its "302/20" unit, which is now in production. This fitting, which was described in the ELECTRICAL REVIEW of December 29th, is for 20 ft. mounting.

The British Thomson-Houston Co., Ltd., has obtained approval of its fittings for 20 ft., 15 ft. and 10 ft. mounting heights (ELEC. REV., December 29th).

NEW ELECTRICAL PRODUCTS

A Review of Equipment Recently Marketed

A Small Cooker

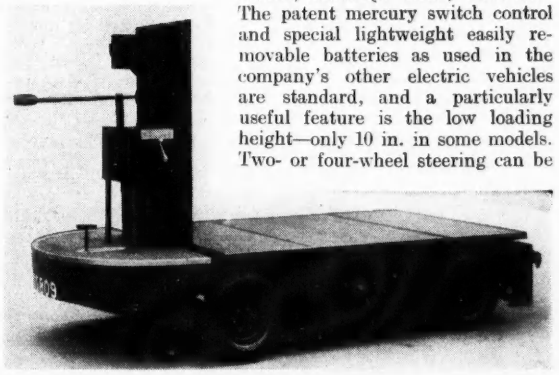
TO meet the increased demand for small cookers the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, has just introduced the "Junior" ("DC.138") model designed on modern streamline principles with a clean enamel finish. It is neatly built to include oven, plate-warming compartment for nine large dinner plates, and grill-boiler at the top. The overall dimensions are 20 in. wide by 14 in. high by 24 in. deep, and a stand is available with a pot-shelf raising the hob to 36 in. above floor level.

G.E.C. "D.C. 138" cooker

The oven, which measures 12 in. wide by 10 in. high by 12 in. deep is fitted with enamelled pressed steel runners as on the well-known "DC.100." A deflector plate, grid shelf and oven pan with grill grid is also included, together with a "Rototherm" oven heat indicator. The grill-boiler (10 in. by 8 in.) also serves as the top heater to the oven. The total loading is 2,800 W (grill-boiler 2,000 W, bottom oven heater 800 W).

Electric Works Trucks

Battery-operated works trucks of capacities up to 2 tons are the latest product of CLECO ELECTRIC INDUSTRIES, LTD., Cleco Works, Hastings Road, Leicester. The patent mercury switch control and special lightweight easily removable batteries as used in the company's other electric vehicles are standard, and a particularly useful feature is the low loading height—only 10 in. in some models. Two- or four-wheel steering can be provided to give a turning circle as small as 13 ft. diameter. The elevated platforms can be either hydraulically or electrically raised, and pneumatic or solid tyres can be fitted.



Cleco works truck

Shop Window Lighting

Two sizes of shop window units conforming with the new Regulations are announced by LINOLITE, LTD., 100, Victoria Street, London, S.W.1. They measure respectively 9 in. by 6 in. by 6 in. and 6 in. by 4 in. by 4 in., and both types are supplied with or without brackets. The front slots are backed with celastoid.

Emergency Lighting

A new "Ediswan" product, of particular use in shelters, casualty stations, fire stations, wardens' posts, &c., is the "Tungar Ensur-a-lite" emergency lighting set. This compact unit consists essentially of a battery and a charger enclosed in a metal case. The battery, which can be either 6 or 12 V, of suitable capacity for the output required, is supplied dry charged, so that in an emergency it would only be necessary to add acid to render the plant ready for service. A charging current of about 5A can be delivered to the battery, but in special cases this can be reduced. As it is realised that a considerable time may elapse after the equipment is installed before it is actually put into service a front shutter is provided, while a locking device prevents unauthorised persons from removing components or tampering with the unit. The makers are the EDISON SWAN ELECTRIC CO., LTD., 155, Charing Cross Road, London, W.C.2.

Electric Bed Warmer

An electric bed-warmer made by BELLING & CO., LTD., Bridge Works, Southbury Road, Enfield, although loaded at only 40-W, warms up quickly, and this warmth is not confined to one small area, since the appliance raises the clothes and allows the heat to spread. It is shaped like the old-fashioned but very efficient warming pan and has smooth, rounded surfaces which make it easy to slide in and out of the bed. Thermostatic control is not provided, but the warmer can be left in the bed for 24 hours or longer without danger. An indicating light shows when the electricity is on.

Belling bed-warmer

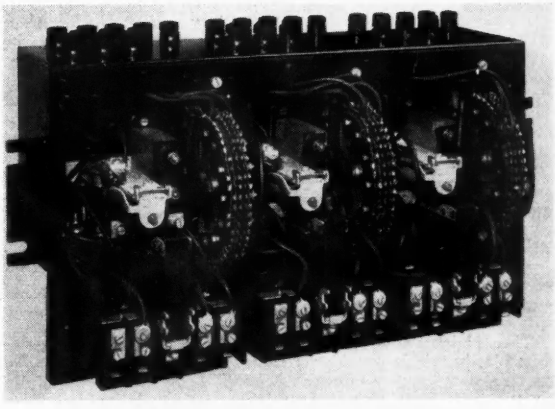
Besides its use for bed warming, the appliance can be employed for airing clothes or hanging on a towel rail. Though very strongly made it weighs only 2 lb. and the neat handle makes it easy to carry about. Three attractive finishes include Margaret Rose, Jubilee blue and primrose yellow. Twelve feet of unkinkable, three-core flex is provided.

Electric Soot Blowers

A new design of electrically driven soot blower equipment which has been introduced by the BRITISH THOMSON-HOUSTON CO., LTD., Rugby, incorporates a considerably more compact control than did earlier models, the floor space occupied being about halved. Very little alteration to the actual blower heads is required, it being necessary only to fit a small limit switch and the scheme is suitable for any make of head.

The control equipment comprises a master panel for all the heads, and a control unit for each head. The accompanying illustration shows the standard arrangement of three control units with the dust-tight enclosing cover removed; the dimensions are approximately 16 by 9 by 8 in. overall, while the master panel occupies about twice this space. These triple units are arranged for mounting in racks either in a special cubicle or in the cubicle of some other boiler house control.

The push-button panels in conjunction with the control give alternatively automatic sequencing of the heads, or the blowing of heads individually. Provision is made for rendering the control of any individual head inoperative either in sequence or individually. By changing the connections on the control unit, the number of blows given by each head can be altered.



B.T.H. control units for soot blower

COMMERCIAL and INDUSTRIAL NEWS

Small Firms and Government Contracts. December Overseas Trade. Plumber Jointers' Wages. New Lighting Order. Midland Industrial Organisation

Electric Vehicle Prospects

SO confident are Associated Electric Vehicle Manufacturers, Ltd., makers of "Morrison" and "Electricar" vehicles, that wartime conditions will bring about a big demand that they are planning to treble or quadruple their present annual production of 1,000 vehicles. This announcement was made last week on the occasion of a Press visit to the Electricar works at Birmingham, when an opportunity was given us not only to witness the production methods but also to inspect thirty or so complete vehicles representative of the various types made by the company. Among these, apart from examples

A line of electric vehicle chassis being demonstrated at the Electricar works

of the standard range, which extends from 8 cwt. to 5 tons, there was a particularly interesting 2-ton van, one of thirty-two converted from Commer petrol vehicles which were otherwise ripe for the scrap-heap.

Welcoming the visitors at a lunch held at the Queen's Hotel, Lt.-Col. L. P. Winby, chairman of the company, declared that the electric vehicle was not merely a wartime measure and had already achieved success before the war. Mr. E. H. A. Richardson, joint managing director, indicating the particular opportunities for the development of the electric vehicle at the present moment, said that its history had been a romance. It had been introduced before the petrol vehicle and was actually the first mechanically propelled road vehicle to reach 60 MPH. It had, however, been handicapped in its early days by the fact that there was not a battery that could be relied upon to have a life of three years. In the past five years there had been a renaissance of the industry due largely to the fact that during the "dark days" one or two firms had continued to develop their vehicles. To-day the Birmingham Salvage Department had nearly 200 electric vehicles in use, and some transport organisations employed as many as 300. They were now being used extensively for the distribution of milk, bread, laundry and coal. Although they were now making progress at a rate greater than at any time in their history, manufacturers were determined to bring the claims of the electric vehicle before the country.

It had an undeniable case for delivery work. No less than 60 per cent. of the transport of this country operated in the urban districts, and of this number only about 75 per cent. averaged more than 30 miles a day. The present-day electric vehicle could carry a pay-load of from 12 cwt. to 10 tons a distance of 40 miles on one charge. On this performance it could seriously contend for a place in the transport of the country.

Government Contracts

The position of small firms in regard to Government contracts is dealt with in a statement issued by the Ministry of Supply in which it is pointed out that anyone is free to apply direct to the Ministry or to the area officers of the Ministry for such contracts, and that all applications are dealt with on their merits. Firms are warned against the employment of intermediaries who represent themselves as being able to influence contracts.

The Ministry's aim is to make as full use of small firms as possible, but it is considered that they would be most useful as sub-contractors. Groups of small firms may be usefully arranged under a parent firm to form units large enough to undertake complete contracts and such groups would be required to state that they agree to allow one firm only to tender and that this firm will enter into the contractual obligations which the Ministry requires. These conditions provide that the parent firm must state on the tender form the names and places of manufacture of the firms concerned, and if any of the firms are already on the Ministry's list they will not be invited to tender separately.

The Ministry has arranged to show samples of munition stores at convenient centres throughout the country, with officers in attendance, and firms wishing to inspect the stores and be advised in respect of their manufacture should write in the first instance to the Ministry of Supply Area Officer who will issue cards of admission.

Overseas Trade in December

In December British exports of electrical goods and apparatus made a further recovery, rising from the November value of £915,770 to £964,036, which compares with £1,128,592 in the last month of 1938. Machinery exports of all kinds (including electrical) in December amounted to £3,653,780, against £3,296,678 in November and £5,113,375 a year ago. Imports of electrical goods and apparatus last month, at £304,354, exceeded the December, 1938, total by £50,377, and imported machinery was also of a higher value, last month's total of £1,726,182 comparing with £1,579,069 a year ago.

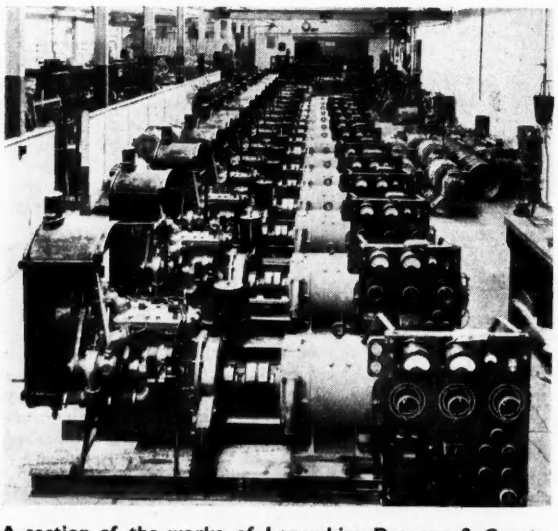
P.O. Engineers' Wages

The London District of the Post Office Engineering Union held a meeting at the Memorial Hall, Farringdon Street, E.C., on January 20th to protest against the refusal of the Chancellor of the Exchequer to sanction negotiations at present for increased remuneration for civil servants. Resolutions passed included a demand for an immediate, substantial all-round increase of wages, and a pledge to continue the present agitation until an adequate wage increase, with provision for frequent review, was obtained. Mr. J. E. Morrish, secretary of the London District Committee of the union, who moved the resolutions, said that the average wage of the workers represented by the union was £3 per week, and there were many adult workers receiving wages as low as 47s. per week.

Lancashire Dynamo Activities

Last year a new high level was achieved in the output of all classes of electrical machinery manufactured by Lancashire Dynamo & Crypto, Ltd. Thus, there has been a large demand for alternators for turbine-drive down to small petrol sets designed for mounting, complete with switchboards, as mobile units. Among the orders received was one for two 400-kVA revolving-field alternators for coupling to engines running on sewage gas.

Repeat orders for sugar factories include one for large high-torque s.c. automatically controlled vertical motors operating on a special duty cycle with quick-braking effected by applying DC to the stator. Other noteworthy contracts have been for "Fankuld" and "Corcooled" motors for what is expected to be the largest flour-mill in the country, two 450-HP s.r. motors with oil-immersed gears for the paper industry, six 525-HP 6.6-kV synchronous motors driving 250-RPM, air compressors and the greatest number of flameproof motors (mainly for refineries, chemical works and petrol pumps) yet built by the company. Work in hand for the machine-tool



A section of the works of Lancashire Dynamo & Crypto, Ltd., showing some of the company's mobile petrol generating sets

trade includes "Lancashire" planer drives for what is believed to be the largest order ever placed for planing machines.

Export orders during 1939 were above the average of the last three years, and among these were one from the Argentine for a large number of geared units and two from Australia.

the first covering more than 4,000 HP of motors for the paper trade, and the second a 600-HP Ward-Leonard equipment for the bucket-line drive of a gold dredger. The South African connection is represented by important orders for the mining industry and several generating sets.

The Foster Engineering Co., Ltd , has also been well occupied and its new switchboard department has been considerably extended.

Electric Cooking in Wartime

Following its policy of "carrying on," the Electrical Association for Women has just completed the replanning of its catering kitchen at its headquarters at 20, Regent Street, London, S.W.1. While the restricted space available has necessitated the sacrifice of some of the Association's kitchen planning principles, it has nevertheless been possible to achieve something which in actual practice is proving its fitness for purpose. A dish-washing machine eliminates breakages while the arrangement of cupboards and shelves facilitates quick service and saves energy. The refrigerator is conveniently placed for both cooking and service and the electric mixer is close to the stores. In addition to a small cooker for general work, there is a double pastry oven which permits of economic baking, since one oven may be used alone and if desired the two compartments can be used to provide very hot and cooler compartments.

At the reopening of the kitchen on Tuesday, Miss Caroline Haslett, the director, mentioned that the replanning had been made possible by donations from the various branches of the Association, and she added that she thought that electricity had a very special use in wartime. In officially declaring the kitchen open, the President of the Association, the Dowager Lady Swaythling, stressed the importance of a healthy and hygienic kitchen, and said that to establish the reputation for good cooking should be the aim of every housewife. She paid a high tribute to the work of Miss Haslett and that of Miss Dorothy Vaughan, who is in charge of the E.A.W. Housecraft School.

In addition to the opening of the kitchen, the Association took the opportunity of arranging a display of apparatus of special use in wartime. Outstanding among these was a combined automatic boiler and electro-steam cooker, which provides full facilities for cooking and hot water for all purposes, and was being shown for the first time. Special utility heaters for A.R.P. stations, and other apparatus designed for saving labour, time and money were also shown. The merits of a refrigerator as a safe A.R.P. food storage cabinet were emphasised. A picture taken at the reopening ceremony appears on page 105.

Wages in the Cable-making Industry

The Joint Industrial Council for the Electrical Cable Making Industry announces that the cost-of-living figure on January 1st (74 per cent. above the 1914 level) will not involve any alteration in wages on the third pay-day in February.

Plumber-Jointers' Wages

The National Joint Industrial Council for the Electricity Supply Industry has announced an increase of ¾d. per hour in the wages of plumber-jointers, jointers and jointers' mates in all districts as from the first full pay period following December 15th, 1939. This increase does not apply to plumber-jointers and plumber-jointers' mates in the Greater London Area (District No. 10), whose wages follow the N.F.E.A.-E.T.U. scale. The Joint Industrial Council for the Electrical Cable Making Industry has notified its members of the increase.

New Lighting Order

A new Order governing the restrictions on lighting has been made by the Minister of Home Security and is now on sale at H.M. Stationery Office, price 6d. It repeats the requirements of the Lighting Restrictions Order of last September making it unlawful to display lights from windows during the hours of darkness. It includes the modifications introduced more recently, namely, those making the "black-out" period last from half an hour after sunset until half an hour before sunrise, enforcing the use of the authorised motor headlamp masks, permitting modified street lighting in all but the specified districts near the coast, and dealing with shop window lighting, shop signs, hand torches, &c. It also contains certain new provisions affecting headlamps on trailers and public service vehicles.

Torch Dimming

A device for varying the light emitted by an electric torch so as to meet official requirements and also to prolong the life of the battery has been provisionally patented by Dr. W. Bier, 11, North End Road, N.W.11. The arrangement consists of a carbon resistance, the value of which is altered by pressure due to a slight turn of a screwed cover at the base of the torch. Full illumination is thus obtainable while the eye is adapting itself to dark surroundings and thereafter the strength can be lessened to suit circumstances. By this means, it is claimed, a paper screen over the lens, which prevents the running of the battery to the limit of its life, is made unnecessary; a lower wattage lamp can be used and the smaller current output increases the useful life of the battery. Also, overrunning of the lamp when the battery is new can be prevented.

Scottish Colliery Explosion

An official inquiry into the Valleyfield (Dunfermline) colliery explosion on October 28th, in which thirty-five men were killed and twenty-six injured, was opened at Edinburgh on January 9th. The Commissioner, Mr. R. P. Morison, K.C., was assisted by Sir Henry Walker, a former Chief Inspector of Mines.

Captain G. Platt, superintending testing officer of the Mines Department Testing Station, Sheffield, said that an "exploder" found 100 ft. from the explosion was of a dynamo-electric type that was not approved for use with coal. He tested it twelve times and each time gas exploded. George Terriss, chief electrician, stated that a spark could be caused by the end of the detonator wires being short-circuited or by a loose connection. The voltage was 150, but with the approved type the lower voltage employed would not produce sparks of such a character as to ignite gas.

Mr. J. Cowan, an assistant electrical inspector of mines, who had spent twenty-seven days examining the electrical apparatus in the part of the pit affected, expressed the view that electricity was not the originating cause. Mr. J. Edwards, senior inspector of mines, East Scotland District, gave as the most probable explanation of the ignition of gas that a shot fired in the top coal was over-charged and partly blew out.

Students' Dance

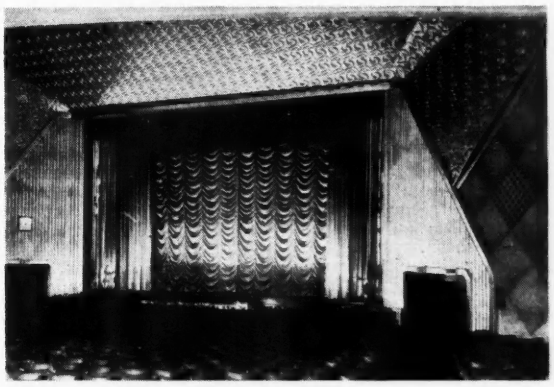
The Students' and Graduates' Sections of the Institutions of Mechanical, Civil and Electrical Engineers will hold their annual joint dance on February 24th, at Baltic House, Leadenhall Street, London, E.C. Tickets (7s. 6d. double, including refreshments) can be obtained from Mr. H. Pettifor, hon. entertainments secretary of the London Students' Section of the I.E.E., 65, The Manor Way, Blackheath, S.E.3. Non-members of the three Institutions will be welcomed.

Price Increase

Dorman & Smith, Ltd., announce that owing to the continued increasing costs of materials, &c., they have withdrawn certain of the advances on their catalogues advised on October 25th, and have substituted revisions.

Cinema Lighting Installation

Many industries have continued in a normal manner despite the outbreak of hostilities and an example of the efforts of the building industry to carry on is shown by the completion of the



The stage and proscenium arch of the Danilo Cinema, Stoke-on-Trent, showing the effect of Holophane decorative lighting

Danilo Cinema at Stoke-on-Trent, which was recently opened. This new cinema has an extensive scheme of Holophane moulded contour decoration, planned by Holophane experts, as a medium for their auto-selective colour lighting system. The architectural design of the cinema includes a silvered surround to the proscenium arch and the splaywalls which is carried on to the front of the ceiling. This silvered portion is composed of fibrous plaster moulded into decorative patterns to produce scientifically planned colour lighting effects of graded light and shade.

The lighting of the auditorium is by means of special proscenium and well battens which are used to illuminate the front of the auditorium. Other battens from the same position are used to light the stage draperies. Along the front of the balcony are concealed Holophane "Cylo" units and similar units are affixed to the back wall over the balcony, for decorative changing light, which can be used for contrast or in harmony with the stage draperies. The Holophane auto-selective system controls all the lighting equipment and the control gear is installed in a room adjacent to the operating room from which the switch panel is built into the division wall, to provide for control from the operating room. The lighting scheme was designed by the colour lighting department of Holophane, Ltd., in collaboration with Mr. A. Glyn Sherwin, the architect.

Factory Lighting

A handbook of 148 pages, illustrated by photographs and twenty-six line drawings and curves, and including ten appendices, has been prepared by the Better Light Committee and issued jointly by the British Electrical Development Association and E.L.M.A. Lighting Service Bureau (Spottiswoode, Ballantyne & Co., Ltd., price 8s. 6d.). It is being circulated to about 25,000 industrial concerns.

The case for good illumination is first stated in relation to visual acuity, reduction of accidents and increased production. This is followed by a chapter explaining the lighting requirements of the Factories Act, 1937, with a reference to the minimum ft.-candle standards prescribed by the Departmental Committee on Lighting in Factories. Enough information is then given about lamps of all kinds to enable a suitable type to be chosen for any given purpose, due regard being paid to colour values. Some space is also devoted to the measurement of illumination on the working plane.

In a chapter on the design of interior lighting installations are presented tables of average ft.-candles recommended for a large variety of manufacturing processes. Typical lamp fittings and their functions are discussed, together with such questions as mounting height and spacing. More than two dozen photographs illustrate the section on special industrial lighting problems and these very clearly indicate the effects of well planned installations in facilitating work of varying complexity. The final chapter is concerned with the wartime control of factory lighting, giving particulars of methods of blacking out, the new B.S.S. and complementary colour schemes.

French Electrical Goods for Spain

The terms of the Franco-Spanish commercial agreement signed last week provide, *inter alia*, for the supply by France to Spain of electrical apparatus to the value of 20 million francs during the current year.

Storage Battery Order

The Edison Swan Electric Co., Ltd., has received an order for two 110-V, 55-cell storage batteries of 250 Ah capacity for the Quernmore sub-station of the Central Electricity Board. The batteries are to be installed under the North-West England Electricity Scheme for switch operation. This makes the sixteenth installation of a similar nature. The order for the Quernmore sub-station was secured through the medium of Kennedy & Donkin, consulting engineers.

A Swiss Jubilee

The Association Suisse des Electriciens has recently celebrated the completion of the first fifty years of its existence by the issue of a special number of its official journal which is largely devoted to the progress and development of the electrical industry in Switzerland during that period.

Midland Industrial Organisation

As indicated recently in the House of Commons, Area Boards and Advisory Committees are being established throughout the country to assist in the development of industrial production for war purposes. The first of these bodies is being set up in the Midland area (with headquarters at Birmingham) to-day, Friday, when Mr. Leslie Burgin, Minister of Supply, is to entertain a number of prominent industrialists and representatives of employees' organisations at luncheon. Employers' representatives on the Area Advisory Committee include Brig.-Gen. A. C. Bayley, D.S.O. (chairman, Engineering and Allied Association, Birmingham, Wolverhampton and Stafford districts), Major C. R. Dibben (Federation of British Industries), and Mr. W. H. Heaton (General Electric Co., Ltd.). Mr. Philip Handley (formerly of the Ministry of Labour) is Secretary of the Area Board.

Electrical Contracting in France

A meeting of Paris electrical contractors has passed a resolution suggesting a change in the distribution of contracts by the public authorities. Instead of the system of competitive tenders it is suggested that an estimate of the cost of work should be made by the public authorities and the contractors' organisation, which would undertake to divide the work among its members, according to their ability to execute it. In this way instead of a few large firms carrying out all the work smaller concerns would also be in position to obtain part.

Registered Electrical Contractors

At the last meeting of the Executive Committee of the National Register of Electrical Installation Contractors, applications for registration were accepted from Ashborn & Minns, Tolworth, Surbiton; and Yates Nunwick & Wood, Malton, Yorks.

E.I.B.A. Returns to London

The offices of the Electrical Industries Benevolent Association are again at 6, Southampton Place, London, W.C.1, after their temporary evacuation to Welwyn Garden City.

Among the substantial subscriptions and donations recently received by the Association are the following:—British Power & Light Corporation, Ltd., £100; Callender's Cable & Construction Co., Ltd., £100; Electric Lamp Manufacturers Association, £100; Johnson & Phillips, Ltd., £100; Metropolitan Electric Supply Co., Ltd. (staff collection), £155. The following annual subscriptions have been received under deeds of covenant:—Mr. R. C. Graseby, £381; Mr. F. Parkinson, £117; Mr. E. E. Sharp, £139.

Scottish Building Centre

A survey of the activities of the Scottish Building Centre covering its first year's operations to September 30th last, has been issued by Mr. I. S. M. Lang, manager of the Centre, who states that the progress during the period under review has been most satisfactory. At the end of the year there were more than 200 exhibitors in the Centre, covering all phases of private and public building construction. A number of exhibitions were held during the year and while certain others had been cancelled owing to the outbreak of war it had since been decided to continue exhibitions during the period of hostilities. Reviewing the Electrical Section, Mr. Lang points out that numerous inquiries have been dealt with from all branches of the building trade and from the public, and visitors to the Section can examine a representative display of electrical appliances. A technical staff, which has a wide range of catalogues and other informative literature, is in attendance to deal with personal inquiries. The fact that since the outbreak of hostilities certain electricity supply undertakings have restricted their showroom activities greatly increases the usefulness of this section. Much benefit has resulted from collaboration with the British Electrical Development Association which has its Scottish office in this section. Arrangements are in progress for a series of visits to the Centre by members of the Electrical Association for Women in Glasgow and district.

Trade Announcements

Thorn Electrical Industries, Ltd., has arranged for the overseas business of Ferguson Radio to be handled by its Export Department, instead of this being undertaken through other sources, as in the past. Two special models have been designed for export, and these are now available in addition to the full 1940 Ferguson range. All inquiries in future should be addressed to Export Department, Thorn Electrical Industries, Ltd., 105/109, Judd Street, London, W.C.1.

Gent & Co., Ltd., announce that their London office personnel will be returning on February 1st to 47, Victoria Street, London, S.W.1 (telephone: Abbey 6888).

Calendars

British Brown Boveri, Ltd., has again sent us a calendar with monthly sheets, each of which bears a charming scene in the Swiss Alps.

A picture of Nelson's Column has been chosen by Corfield Sigg, Ltd., for their monthly calendar.

A handy engagement pad has been received from Hipprum Wires, Ltd.

Prices of Materials

Henry Gardner & Co., Ltd., report, January 24th: No change in the prices of copper bars (best selected), sheet and rod, English pig lead and spelter. English block tin, £232. £10 10s. decrease.

No change in the prices of materials was reported on January 24th by Edward Till & Co. (india-rubber, Para fine), and F. Smith & Co. (electrolytic copper bars, wire rods and h.c. wire).

Catalogues Required

Goodall, Lamb & Heighway (1936), Ltd., of 15, King Street, Manchester, who have carried out a good deal of electrical work for many years past, have decided to open a department to deal exclusively with electrical contracts, and they ask for electrical manufacturers' catalogues.

New Catalogues and Lists

Benjamin Electric, Ltd., Brantwood Works, Tottenham, London, N.17.—A booklet pointing out the advantages resulting from the use of good lighting in factories, and also a folder giving details of the new white "Coolicon" shade which is practically unbreakable.

British Aluminium Co., Ltd., Raven Hotel, Castle Street, Shrewsbury.—Addenda to "Chemical Analysis of Aluminium and its Alloys" issued recently.

E. K. Cole, Ltd., Southend-on-Sea.—An illustrated catalogue of electric lamps drawing especial attention to care taken by the company to ensure consistency and reliability.

H. Atkinson & Sons, Salford Mill, Todmorden, Lancs.—A leaflet describing the "Sydney" electrically heated washer.

Croydon Engineering Co., Ltd., Commerce Way, Purley, Croydon.—A leaflet on the "Paragon" earth cone.

Monitor Patent Safety Devices, Ltd., Wallsend-on-Tyne.—Particulars of the "Monitor" pressure alarm with indicator panel combined.

Tucker & Edgar, Berkley Works, Berkley Road, London, N.W.1.—An illustrated leaflet describing "Teeanee" A.R.P. lighting units.

Information Department

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, &c., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

We should be glad to have such information regarding the following:—

HI-LITE torch batteries.

HOLMWOOD patent luminous switch dolly.

ELECTRICITY SUPPLY

Croydon's New Power Station Scheme Postponed. Hire Charges Controversy at Fleetwood. Stafford Change-over Proposal. Bulk Supply Charges in North Wales

Billingham-on-Tees.—HIGH-VOLTAGE CABLE.—The North-Eastern Electric Supply Co., Ltd., proposes to lay a 66-kV cable from the generating station to the junction of Belasis Lane and Cleveland Avenue.

Brierfield.—LOAN APPLICATION.—The Council is applying to the Electricity Commissioners for permission to borrow £1,000 for consumers' assisted wiring and £2,000 for electricity meters.

Chester.—SUPPLY TO HOSPITAL.—At a cost of £2,400 the Electricity Committee is to provide a supply to the Backford Hospital.

Croydon.—POWER STATION SCHEME POSTPONED.—The war has led the Central Electricity Board to postpone completion of an agreement with Croydon Corporation for the construction, at a cost of £1,300,000, of a new generating station. It was reported at Monday's meeting of the Borough Council that as soon as the recovery of the load in Croydon made the provision of further plant necessary, the erection of the station would proceed. In the meantime, arrangements have been made to ensure that no financial burden falls upon the Council in consequence of the postponement of the scheme.

RING MAIN TO BE COMPLETED.—The Electricity Committee is to complete the ring main at a cost of £33,060. It is proposed that the work should be carried out by Standard Telephones & Cables, Ltd., as an extension of their contract.

DISTRIBUTION PROJECTS.—Cables are to be extended to Hartland Way at a cost of £3,893, Woodmere Avenue (£1,301), Eldon Park (£383), Spout Hill (£561), Shirley Church Road (£1,645), and other places at a cost of £3,000.

REPAIRS AT POWER STATION.—It is proposed to repair the cooling tower at the power station at a cost of £1,550, and renew the steel boiler chimneys (£520). A modified coal handling and storage scheme is to be provided at a cost of £4,000.

Dumfriesshire.—PROGRESS OF UNDERTAKING.—Mr. Bell-Macdonald reported to a meeting of the Dumfries County Council on the progress of the electricity undertaking and stated that substantial development had continued. The total output for 1939 was 17 per cent. up on the previous year. The new tariff contained only small amendments—a minimum charge of 5s. per quarter for flat-rate slot meters, and a quarterly meter rent of 1s. 6d. for two-part tariff slot meters. The hire charge for cookers was also to be increased by 1s. per quarter and a connection charge of 5s. introduced for new wiring for hired apparatus. None of these increases would apply to existing contracts but only to new work.

Fleetwood.—INCREASE IN HIRE CHARGES CONTESTED.—Surprise was expressed at a meeting of the Electricity Committee when it was reported that officials, and a number of members, were under the impression that the recent 7½ per cent. increase in charges would apply to hire charges of appliances. One member contended that the Council could not legally put an extra charge on appliances previously issued to householders. If the extra charge had already been made users were entitled to full rebate. Some appliances had been in use many years, and could not possibly be affected by wartime increases. Alderman C. Saer (chairman) said there had been considerable increases in maintenance costs since the war. Mr. W. P. Lilwall, the electrical engineer, was instructed to prepare a statement showing how the increased maintenance costs of hired appliances affected the finances of the undertaking.

Glasgow.—HOSPITAL INSTALLATION.—The Education Committee has agreed to the existing wiring at Nerston Home, which is of a temporary nature, being replaced at an estimated cost of £130.

Greenock.—STANDBY POWER PLANT.—The Council is to install an alternator set for emergency lighting at Gateside Hospital at a cost of approximately £223.

Horbury.—INSTALLATIONS IN COUNCIL HOUSES.—The Urban District Council has under consideration the installation of electric lighting in Council houses.

Lichfield.—INCREASE IN CHARGES.—Approval has been given by the Council to an increase in electricity charges by a percentage sufficient to cover the estimated deficiency during 1940-41.

London.—ELECTRIC PUMPING.—The Metropolitan Water Board proposes to install electric pumping equipment at the Deptford works at a cost of £550.

ISLINGTON.—The Electricity Committee has approved a revised estimate of £5,053 for the provision of a sub-station in Sotheby Road and the further development of the distribution system.

FULHAM.—At Wednesday's meeting of the Council the borough electrical engineer reported that a modified form of staircase lighting complying with the regulations had been devised. It was decided to make provision for such lighting on the Council's estates.

ST. PANCRAS.—It has been decided to increase the electricity charges by the following amounts: Lighting flat rate, 1d.; advertising lighting separately metered, ½d.; advertising lighting, assessed, and signs, ¼d.; industrial power, ¼d.; cooking and heating, ¼d.; and "unit" charge under all two-part tariffs, ¼d.

BERMONDSEY.—The Electricity Committee reports that to comply with the anti-fire recommendations of the Electricity Commissioners, the London Power Co. is to install carbon dioxide fire extinguishing equipment to protect the 22-kV switchgear in the Neckinger sub-station and the London Electric Supply Corporation also, in collaboration with the London Power Co., is considering the installation of similar equipment to protect its transformer and switchgear at Neckinger. The Committee considers it advisable for the Council's own apparatus to be similarly protected and for the equipment of the whole sub-station to be planned and erected as one complete installation, the Council paying its due proportion (estimated at £1,200) of the total costs.

POPLAR.—The Electricity Committee is to carry out a change-over in four small areas at a cost of £2,586.

Middlesbrough.—HOSPITAL LIGHTING SCHEME.—A report has been prepared for the Town Council showing that the cost of changing the lighting of the Hemlington Hospital from gas to electricity will be about £600. The matter is still under consideration. The Town Council is also considering carrying out improvements to the deep therapy X-ray apparatus at the Holgate Hospital at a cost of £470.

Newcastle-on-Tyne.—PROPOSED SUB-STATION.—The North-Eastern Electric Supply Co., Ltd., is negotiating for a site at Pandon for the erection of a sub-station.

North Wales.—COST OF ELECTRICITY.—Representatives of about 30 electricity undertakings in North Wales attended a recent conference at Rhyl, convened by the North Wales and South Cheshire Local Authority Electricity Undertakings' Association, to consider the cost of electricity in their areas. Under the proposed new charges of the power company local authorities in North Wales who are members of the Association are called upon to pay £168,898 for their electricity supplies, an increase of about £4,000 on the previous scale. The places chiefly affected by the increases are Hawarden, Rhyl and Caernarvon, while those which will pay less for their bulk supplies are Llandudno, Colwyn Bay and Conway. One suggestion was that authorities which were not badly hit should be called upon to assist in relieving places where the increases might prove burdensome. It was decided to defer consideration of this suggestion to the next meeting of the Association.

Penzance.—OPPOSITION TO BILL.—The Town Council recently endorsed the action of the town clerk in communicating with other local authorities in the county with a view to opposing a Bill which the Cornwall Electric Power Co. is promoting. Truro City Council and Camborne-Redruth U.D.C. have decided to support the opposition to the Bill.

Perth.—NO PRICE INCREASE.—It was stated at a recent meeting of the Council that it was not proposed to increase electricity charges at present.

Stafford.—CHANGE-OVER SCHEME.—The Electricity Committee reported to the Council last week that the engineer had prepared a provisional scheme for change-over from DC to AC, the total cost for the whole area being £22,000, exclusive of the cost of conversion of factories and workshops and that in respect of new metering equipment and distribution plant. The Committee, it was stated, had decided to make application to the Electricity Commissioners for consent to proceed with the initial portion of the scheme from Mill Bank to the borough boundary, at an estimated cost of £3,200.

Taunton.—SALE OF ELECTRICAL FITTINGS.—At a recent meeting of the Town Council, when the Electricity Committee reported having had under review the scheme adopted in February, 1939, relating to the sale of electrical fittings, and recommended that the scheme be continued for a further period of one year, members pressed for a review of the system. The amendment was carried, and an assurance was given that figures would be presented on the operation of the scheme and also on the effect of the increased charges on the past quarter's revenue.

Tynemouth.—PROPOSED SUB-STATION.—The Electricity Committee has obtained a site for sub-station on the Chirton Hill estate.

RESUMPTION OF WIRING SCHEME.—Application is being made to the Electricity Commissioners and the Treasury for permission to resume the wiring scheme which was abandoned on the outbreak of war.

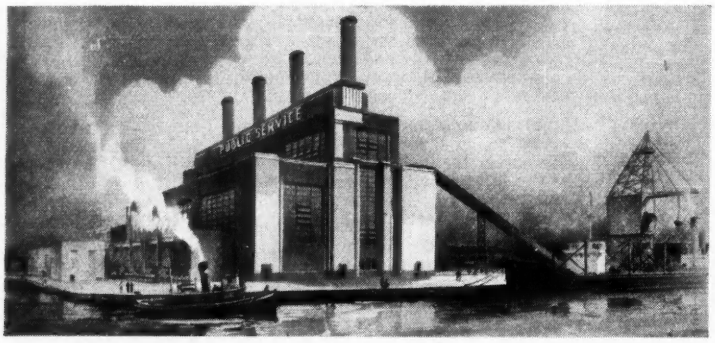
LIGHTING SCHOOL A.R.P. SHELTERS.—The Town Council has decided to install electric lighting in school air-raid shelters.

Utkinton.—FRINGE ORDER.—The Mid-Cheshire Electricity Supply Co., Ltd., is seeking a Fringe Order to supply premises in the area.

Wood Green.—SITE FOR SUB-STATION.—The Northmet Power Co. has acquired a site for a sub-station in Wolves Lane.

Overseas

Egypt.—POWER SCHEME.—In the course of an article in a recent issue of *L'Egypte Contemporaine* M. A. J. Dorra refers to the scheme for the establishment of a 400,000-kW hydro-electric power station in connection with the Aswan dam on the River Nile, which the Cabinet is believed to have decided to carry out. The author considers that such a plant would meet the growing demand for electric power supply in Egypt for the next ten years. According to the latest figures available there are only 58 towns and villages with a population of 3,611,000 people in the country which have an electricity supply, or 22.6 per cent. of the total population. The scheme, if carried through, would entail the establishment of a power transmission line about 660 miles in length in order to give a supply to the large consuming centres in Lower Egypt. It is suggested that this should comprise a double 220-kV line between Aswan and Cairo and a double 110-kV line between Cairo and Alexandria.



Architect's impression of the new Burlington power station of the Public Service Electric and Gas Co. of New Jersey

France.—INTERCONNECTING TRANSMISSION LINE.—The Ministry of Public Works has approved the concession of rights to build and operate a new overhead line between an existing sub-station at Beautor, in the Aisne, and Vendin le Vicil, in the Pas de Calais department. It will comprise three aluminium conductors, steel cored for the greater part of their length, of a minimum cross-sectional area of aluminium of 238 sq. mm., and a steel earth wire of 50 sq. mm. cross-sectional area. The line will be designed for the transmission of 40,000 kW at 150 kV between phases, with a line loss of about 11 kW per kilometre. This important line will constitute a tie between the transmission system in the north of France and that in the south and east; it will permit a better distribution of power both in the north, where the resources are largely thermal, and in the south, where they are largely hydraulic.

Manchukuo.—AMALGAMATION OF SUPPLY COMPANIES.—The merging of electric light and power companies is making steady progress, and the Manchukuo Electric Corporation has already taken over by purchase ten companies, including the Peian Electric Co. and the Huatian Electric Corporation. There are now only seven companies in Manchukuo outside the combine.

Switzerland.—NEW HYDRO-ELECTRIC STATION.—To replace an old plant a new hydro-electric station is being established on the Rhine near Geneva, between the Coulouvreniere and Chancy-Pougny plants. The station, which will work under a head of about 68 ft., will be equipped with four sets of 31,500-HP Kaplan turbines coupled to alternators generating at 18 kV. For transmission to the regional distribution system the power will be stepped up to 125 kV.

United States.—POWER STATION CONSTRUCTION PROBLEM.—The building of the $12,000,000 Burlington power station for the Public Service Electric & Gas Co., New Jersey, started a short time ago, and one of the first steps presented an engineering problem. The new station is being constructed on property through which condensing water was returned to the Delaware River by means of an open ditch from the old station. In order to proceed with the new station, it was necessary to divert this flow of about 60,000 gal. per min. The first step was the construction outside the area of a new discharge tunnel to take care of the old plant. This was done without altering the flow from the old station. It was then necessary to divert the flow from the temporary open ditch into the new tunnel, and to do this with the shortest possible shut-down. A steel pipe, 5 ft. in diameter, was lowered into the discharge trench and connected to the outlet at the wall of the existing station at one end, and to the inlet of the new discharge tunnel at the other.

It was estimated that by careful scheduling and supervision, plus quick work by the 116 men (two shifts) the job could be done in 18 hours. Actually it was completed without hitch in 17 hr. 11 min. The first shift consisted of 68 men and the second, 48. Difficulties were added to working conditions inasmuch as the time factor made it necessary for the men to start before the water had been drained from the ditch. The Burlington turbines were shut down while the work was in progress, but there was no interruption of service in the area. Power was supplied over the company's Southern Division transmission system from Trenton and Camden.

The new station, which will increase the capacity from 55,000 to approximately 350,000 kW, is scheduled for completion not later than the spring of 1941.

Local Authorities' Lighting Plans

EXPERIMENTAL installations of modified lighting in Manchester Road and Britannia Road, Colne, have been authorised by the Electricity Committee. In another Lancashire town—Brierfield—it has been decided to introduce the new system as soon as the fittings can be obtained.

At its last meeting the Hawick Town Council tentatively agreed to the provision of a restricted form of street lighting. Bourne Urban District Council has the matter under discussion, but the Eton U.D.C. has deferred consideration of the question and Pewsey Council has decided to take no action. Barnes Borough Council is waiting until the results of experiments with the new lighting are better known and it has been adopted by the London boroughs generally.

Shaftesbury Highways and Lighting Committee recently instructed the Town Clerk to endeavour to obtain a demonstration fitting. A preliminary estimate for modified lighting at Hackney, covering the whole of the borough, is £4,000. Experiments are being carried out.

East Ham Emergency Committee has confirmed the action of the borough engineer in ordering fittings for all main-road standards. At Ilford an experimental installation is being provided in Cranbrook Road although, according to the *Ilford Guardian*, the Mayor thought that the small benefit of the lighting was not worth the cost.

Streets in the centre of Stratford-on-Avon are to be provided with modified lighting. Fleetwood has ordered 200 fittings. At Weymouth a report is being submitted on the question, while Farnham Council is purchasing six fittings to try their effect. Worksop Borough Council has decided to experiment with the system and Brownhills U.D.C., whose chairman recently stated that he was sure the inhabitants of the district would be delighted to get some form of street lighting, is doing likewise.

Cowling Council considers that no useful purpose would be served in incurring the expense of modified lighting now, but will review the matter if the black-out is in force next winter.

At Hendon it was reported that the borough engineer was in communication with the various supply companies regarding modified lighting.

Derby is to experiment with 50 of the new lamps. Loughborough's new 15-W street lamps were used to illuminate the Market Place experimentally on January 17th. At Leicester a trial installation is being carried out in Charles Street.

Croydon Electricity Committee has prepared a wartime street lighting scheme at a cost of £3,700. At Rushden experiments are to be undertaken while Darlington Town Council is to spend £369 on fittings. Chester Watch Committee has arranged for the electrical engineer to install experimental lighting at a cost of £20. Exeter Lighting Committee reports that wartime lighting will cost £993; having regard to the small amount of illumination it does not recommend any action at present.

A suggestion that searchlights might be used for public lighting is made in a report by the Fulham Civil Defence Emergency Committee, which has had under consideration the Government's decision to modify the Lighting (Restrictions) Order so as to permit the restoration of a modified form of street lighting. It is stated that while the Electricity Committee will, of course, be dealing with the circular of the Minister of Home Security in connection with the street lighting of the borough, the Civil Defence Committee has taken the opportunity of drawing the attention of the Minister to the possibility of using searchlights for street lighting purposes. On a recent occasion it was observed that the whole of the borough was comparatively well illuminated by a single searchlight which was in use at a point outside the borough, and the intensity of the lighting so provided vastly exceeded that which can be anticipated from the new form of modified street lighting.

NEW PATENTS

Electrical Specifications Recently Published

Compiled by a firm of chartered patent agents. The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1938

8791. "Electric methods of and systems for governing the recording or controlling action of an instrument." C. J. Tagliabue Manufacturing Co. March 22nd, 1937 (Cognate application 8792/38). (516338.)

12406. "Switch or control arrangement for operating X-ray apparatus." P. Seligmann (F. Dessauer and K. Lion). April 26th, 1938. (516219.)

13503. "Vacuum electric - discharge tube devices." J. H. Ludlow, and Metropolitan-Vickers Electrical Co., Ltd. May 5th, 1938. (516282).

17730. "Automatic or semi-automatic telephone systems." J. E. Pollak (Associated Telephone and Telegraph Co.). June 14th, 1938 (Cognate applications 34908/38 and 308/39). (516348.)

18205. "Switch control mechanism, particularly suitable for electric cookers." J. A. Crabtree and Co., Ltd., J. A. McLoughlin and B. G. Harrison. June 20th, 1938. (516349.)

18221. "Electric cables or other insulated conductors." Pyrotenax, Ltd., F. W. Tomlinson and C. M. Beckett. June 20th, 1938. (516285.)

18257. "Cathode-ray tubes." Baird Television, Ltd., and V. A. Jones. June 20th, 1938. (516351.)

18273. "Tone-control circuits for audio-frequency amplifiers." Mullard Radio Valve Co., Ltd., and R. G. Clark. June 20th, 1938. (516286.)

18376. "Generators of electrical oscillations of saw-tooth wave form." Telefunken Ges. für Drahtlose Telegraphie. June 21st, 1937. (516357.)

18423. "Stabilised negative resistance and conductance devices." Standard Telephones and Cables, Ltd., and B. B. Jacobsen. June 21st, 1938. (516358.)

18426. "Attenuator networks for use in wave transmission systems." Standard Telephones and Cables, Ltd., and R. A. Meers. June 21st, 1938. (516359.)

18436. "Telephone systems." J. E. Pollak (Associated Telephone and Telegraph Co.). June 21st, 1938. (516235.)

18448. "Lighting fittings." British Thomson-Houston Co., Ltd., and R. Maxted June 21st, 1938. (516361.)

18515. "Electric measuring systems." Bailey Meters and Controls, Ltd. July 9th, 1937. (516236.)

18538. "Electric heating devices." General Electric Co., Ltd., and G. S. Cattell. June 22nd, 1938. (516364.)

18548. "Electric circuit-breaking devices of the gas-blast type." A. Reyrolle and Co., Ltd., and F. Coates, B. H. Leeson and A. Allan. June 22nd, 1938 (Cognate application 16269/39.) (516238.)

18563. "Measuring instrument, particularly for testing electrical insulation." Metrawatt Akt.-Ges. Fabrik Elektrischer Messgerate. June 23rd, 1937. (516176.)

18577. "Three-phase electric transformers or choking coils." Siemens Schuckertwerke Akt.-Ges. August 10th, 1937. (516177.)

18583. "Distributors for magneto generators." Bendix Aviation Corporation. July 7th, 1937. (516243.)

18595. "Single and multiple contact electrical plugs." C. R. Cook. June 22nd, 1938. (516244.)

18678. "Electrically heated units for permanent hair-waving." A. S. Raymond. June 23rd, 1938. (516370.)

18698. "Telegraph apparatus." Cable and Wireless, Ltd., and F. Warburton. June 23rd, 1938. (516373.)

18723. "Cathode-ray tubes." Telefunken Ges. für Drahtlose Telegraphie. June 24th, 1937. (516246.)

18745. "Electric shutter-release for photographic cameras." D. J. Towell. June 24th, 1938. (516378.)

18749. "Electrical estimation of the moisture-content of materials." British Cotton Industry Research Association and E. H. Jones. June 24th, 1938. (516379.)

18793. "Apparatus for neutralising static electrical charges carried by travelling webs, threads, or the like." C. R. A. Chadfield. June 24th, 1938. (516383.)

18794. "Apparatus for generating high potential static electricity." June 24th, 1938. (516384.)

18799. "Electro-magnetic relays." Standard Telephones and Cables, Ltd., and E. A. H. Bowsher. June 24th, 1938. (516386.)

18800. "Electric discharge devices, and cathodes therefor." Standard Telephones and Cables, Ltd., and F. D. Goodchild. June 24th, 1938. (516387.)

18801. "Electric oscillators and calibrating means therefor for producing any desired frequency in a given range of frequencies." Standard Telephones and Cables, Ltd., and R. M. Barnard. June 24th, 1938. (516388.)

18811. "Television receivers." Scophony, Ltd., A. F. H. Thomson and A. H. Rosenthal. June 24th, 1938 (Cognate applications 18812/38 and 20276/38). (516247.)

18837. "Holders for incandescent electric lamps." Weymann's Motor Bodies (1925), Ltd., and H. A. Cook. June 24th, 1938. (516290.)

18884. "Electrical servomotor systems." Smith & Sons (Motor Accessories, Ltd., and F. W. Meredith. June 25th, 1938. (516393.)

18900. "Electric switches of the tumbler type." R. H. Baker and C. W. Parsons." June 25th, 1938. (516395.)

19402. "Electric battery lamps for miners' use." Ceag, Ltd., and R. J. Plummer. June 30th, 1938. (516296.)

19446. "Devices for anchoring the end of an electric cord to a portable piece of electric apparatus." British Thomson-Houston Co., Ltd. July 1st, 1937. (516297.)

19578. "Mechanical devices for producing intermittent rotating motion by means of electric impulses." Soc. Anon. Fimi. July 21st, 1937. (516299.)

19586. "Construction and method of making electric contact plugs." P. De Beauvais. July 1st, 1938. (516300.)

19770. "System of connections between the components of a wireless apparatus having a remote controlling device." Soc. Anon. Fimi. July 21st, 1937. (516302.)

19816. "Clinch ears for supporting grooved electric trolley wires." R. Livingstone, and Anti-Attrition Metal Co., Ltd. July 5th, 1938. (516249.)

19913. "Electric heat storage devices." General Electric Co., Ltd., L. J. C. Connell and O. W. Humphreys. July 5th, 1938. (516305.)

20695. "Electric alarm systems." R. E. H. Carpenter and P. P. Eckersley. July 12th, 1938. (Cognate application 30189.) (516192.)

20706. "Electron-discharge and like devices and electrodes therefore." Telefunken Ges. für Drahtlose Telegraphie. July 24th, 1937. (516193.)

20920. "Fusible electric cut-outs." British Thomson-Houston Co., Ltd. July 14th, 1937. (516197.)

20951. "Electrical instruments for indicating or recording variables." A. Patin. July 14th, 1938. (516198.)

20999. "Crossings and frogs for overhead electric traction systems." N. H. Thomas, and London Passenger Transport Board. July 15th, 1938. (516323.)

21002. "Fuses for the protection of electric circuits." Callender's Cable & Construction Co., Ltd., L. G. Brazier and A. W. Metcalf. July 15th, 1938. (516324.)

21127. "Magnetically operated electric contactor switches." F. Heaton. July 16th, 1938. (516326.)

21193. "Plug-and-socket connectors." J. H. Tucker, Ltd., F. C. Fuke and A. C. Sharman. July 16th, 1938. (516205.)

21261. "Inductive elements adapted for co-operation with high-pressure metal-vapour electric-discharge lamps." General Electric Co., Ltd., W. F. S. Debenham and V. J. Francis. July 18th, 1938. (516206.)

21376. "Electro-magnetic step-by-step selectors." Ericsson Telephones, Ltd. C. W. Wilman. July 19th, 1938. (516208.)

21398. "Television and like receivers." General Electric Co., Ltd., and D. C. Espley. July 19th, 1938. (516252.)

21399. "High-pressure mercury-vapour electric-discharge lamps." General Electric Co., Ltd. (Patent-Treuhand Ges. für Elektrische Glühlampen.) July 19th, 1938. (Addition to 504432.) (516253.)

21427. "Electrical devices for determining the angle of torsion in rotary machine parts." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. July 22nd, 1937. (516254.)

21505. "Electric heating devices for rooms and other enclosed spaces." Co-operative Wholesale Society, Ltd., and R. H. Line. July 20th, 1938. (516258.)

21636. "Automatic temperature-controlled electrically heated appliances." G. Green (Gee Gee), Ltd., and G. E. Green. July 21st, 1938. (516331.)

21771. "Emergency power-generating plant." English Electric Co., Ltd., and R. J. Welsh. July 22nd, 1938. (516265.)

22551. "Means for conveying metallic articles through electroplating or like apparatus." Brightside Plating Co., Ltd., and J. Kronsbein. July 29th, 1938. (Addition to 483593.) (516215.)

22903. "Electric welding." Linde Air Products Co. August 10th, 1937. (516404.)

6095. "Automatic or semi-automatic telephone systems." J. E. Pollak (Associated Telephone & Telegraph Co.) June 14th, 1938. (Divided out of 516348.) (Cognate applications 309/39 and 6097/39.) (516408.)

6096. "Automatic or semi-automatic telephone systems." J. E. Pollak (Associated Telephone & Telegraph Co.) June 14th, 1938. (Divided out of 516348.) (Cognate applications 21312/38, 310/39 and 6098/39.) (516409.)

TRADE MARK APPLICATIONS

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 17th.

Reliance. No. 577479. Class 8 (III.) Electric flexibles and cables.—Reliance Electrical Wire Co., Ltd., Gresham House, Old Broad Street, London, E.C.2.

U.S.S. (lettering and design). No. 608082. Class 9 (IV.) Signalling apparatus for the control of traffic, electro-magnetic signal and point lever locking devices, and electric switch circuit controllers for railway tracks.—The Union Switch and Signal Co., Swissvale, Penn., U.S.A. (British representatives, Reddie and Grose, 6, Bream's Buildings, London, E.C.4).

Acme. No. 608155. Class 9 (IV.) Apparatus for electrically charging wire fencing.—F. Hills and Sons, Ltd., Norton Road, Stockton-on-Tees.

Selex (lettering and design). No. 608300. Class 9 (IV.) Fire detecting installations, comprising electric circuits, thermostats, alarms and indicating panels, and parts of such installations.—Walter Kidde and Co., Inc., New York, U.S.A. (British representatives, Marks and Clerk, 57-58, Lincoln's Inn Fields, W.C.2).

FINANCIAL SECTION

New Companies. Returns of Capital. Debenture Charges. Bankruptcies and Liquidations. Reports of Electrical Companies. Dividend Announcements. Stocks and Shares

New Companies Registered

Alliance Electrical Co., Ltd.—Private company. Registered January 18th. Capital, £2,500. Objects: To acquire all or part of the business of electricians and electrical engineers carried on by the Alliance Electrical Co., Ltd. (in liquidation). The first directors are W. F. White (permanent chairman) and Miss E. McArthur, addresses not stated. Solicitors: Stoneham & Sons, 108a, Cannon Street, London, E.C.4.

England Battery Co., Ltd.—Private company. Registered January 18th. Capital, £500 in £1 shares. Objects: To carry on business as manufacturers of and dealers in batteries, magnetos, dynamos and electrical plant and accessories of all kinds, &c. Directors: B. Higginbottom and Mrs. E. Higginbottom, both of 48, Milnrow Road, Rochdale. Registered office: 50, Milnrow Road, Rochdale.

Everett & Philpott (Sales), Ltd.—Private company. Registered January 20th. Capital, £100. Objects: To carry on the business of manufacturers and concessionaires of, dealers in, and factors and contractors for electrical and mechanical appliances, and in particular electrical and mechanical appliances used in offices, &c. Directors: A. E. Sabey, Manor Lodge, Northwood, Middlesex, and three others. Registered office: 100, Great Russell Street, W.C.1.

Chromasil, Ltd.—Private company. Registered January 20th. Capital, £1,000. Objects: To carry on the business of electroplaters, processors of metals and materials, including the deposition of metal or other materials by electrochemical or other actions or methods, &c. The subscribers are: W. A. Prestage and P. C. Watt, both of 14, Bolton Street, W.1. Secretary: W. A. Prestage.

Frank Watson (Croydon), Ltd.—Private company. Registered January 17th. Capital, £1,000. Objects: To carry on the business of motor and electrical and wireless and television engineers, dealers in motor cars and electrical accessories, &c. The subscribers are: F. W. Watson and L. R. Watson, both of "The Corner," Coombe Lane, Croydon. F. W. Watson is permanent governing director.

Companies' Returns

Statements of Capital

Southern Brazil Electric Co., Ltd.—Capital, £507,800 in 182,800 preference shares of £1, and 650,000 ordinary shares of 10s. Return dated September 13th, 1939. All shares taken up. £3 10s. paid on 7 ordinary shares. £507,796 10s. considered as paid on the remainder. Mortgages and charges: £756,415.

Sun Electrical Co., Ltd.—Capital, £250,000 in 125,000 7½ per cent. preference and 125,000 ordinary shares of £1. Return dated December 1st, 1939. 125,000 preference and 93,311 ordinary shares taken up. £218,311 paid. Mortgages and charges nil.

Sloan Electrical Co., Ltd.—Capital, £60,000 in 10,000 preference and 50,000 ordinary shares of £1. Return dated December 4th, 1939. 8,000 preference and 40,000 ordinary shares taken up. £41,500 paid on 3,000 preference and 38,500 ordinary shares. £6,500 considered as paid on 5,000 preference and 1,500 ordinary shares. Mortgages and charges: £60,500.

Mosbrough Electric Supply Co., Ltd.—Capital, £5,000 in £1 shares. Return dated December 7th, 1939. 3,275 shares taken up. £3,275 paid. Mortgages and charges nil.

Highgate Cable & Engineering Co., Ltd.—Capital, £1,000 in £1 shares. Return dated December 8th, 1939. 600 shares taken up. £600 paid. Mortgages and charges, nil.

Pollard and Smith, Ltd.—Capital, £2,000 in £1 shares. Return dated December 9th, 1939. All shares taken up. £2,000 paid. Mortgages and charges, nil.

Mortgages and Charges

Parmeko, Ltd.—Mortgage on land and premises in Percy Road and Vernon Road, Leicester, and the company's undertaking and other property, present and future, including uncalled capital, dated December 30th, 1939, to secure all moneys due or to become due from the company to the District Bank, Ltd.

Increase of Capital

Hivac, Ltd.—The nominal capital has been increased by the addition of £7,400 in £1 ordinary shares, beyond the registered capital of £100.

Private Arrangement

C. F. Williams, electrical engineer, 119, West Street, Farnham, Surrey.—At a meeting of the creditors a statement of affairs was submitted which showed ranking liabilities of £2,489, and in addition the bankers were fully secured creditors for £2,328. The assets were £955, being a deficiency of £1,534. Recently creditors had pressed, and in order to protect the assets a deed of assignment had been executed in favour of Mr. N. W. Osborne, C.A., 11-12, Finsbury Square, London, E.C. A resolution was passed confirming the deed, and a committee of the three largest creditors was also appointed.

Company Liquidations

McKay (Harrow), Ltd., electrical engineers, 320, Eastcote Lane, South Harrow, Middlesex.—At the statutory meeting of the creditors the statement of affairs disclosed ranking liabilities of £668 against net assets of £203, leaving a deficiency, as regarded the creditors, of £465. The issued capital of the company was £540 and so far as the shareholders were concerned there was a deficiency of £1,005. The creditors decided that the voluntary liquidation of the company should be continued with Mr. F. E. Bendall, of Bendall, Poppleton & Appleby, 4, Charterhouse Square, London, E.C., as liquidator.

Walbeck Electrical Co., Ltd., 150, Askew Road, Shepherds Bush, London, W.12, electrical factors.—The statutory meeting of creditors was held recently at the offices of Morgan & Co., 11, Argyll Street, London, W. The statement of affairs disclosed liabilities of £257, while after allowing £5 for preferential claims the net assets were £208, leaving a deficiency, as regarded the creditors, of £49. The issued capital was £258, and so far as the shareholders were concerned there was a deficiency of £307. It was unanimously resolved that the voluntary liquidation of the company should be continued, with Mr. H. Goodier, C.A., of Morgan & Co., as liquidator.

Andrew, Son & Ballard, Ltd.—Particulars of claims by February 6th to the liquidator, Mr. E. T. Rix, Brook House, Brook Green Road, Hammersmith, London, W.6.

Bankruptcy Proceedings

L. Jacobs, radio dealer, trading as Loujay Radio, 162, High Street, Peckham, S.E.—This debtor attended the London Bankruptcy Court on January 18th for his public examination before Mr. Registrar Kean. The statement of affairs showed liabilities of £765 and assets estimated at £100. Debtor attributed his failure to losses under hire-purchase agreements, keen competition and depression in trade. The examination was closed.

J. F. B. Wallen, 41, Prince George Avenue, Enfield, lately carrying on business at 191, Elgin Terrace, Maida Vale, under the style of Auto Radio Co., radio dealer.—This debtor applied for his discharge at the London Bankruptcy Court on January 16th before Mr. Registrar Parton. The Official Receiver reported that the debtor failed in February, 1938, the liabilities amounting to £1,812, and no assets had been recovered. The Registrar remarked that there were several unsatisfactory features about the case, and suspended the discharge for three years.

S. Lancaster, wireless dealer, 15, Hallwood Avenue, Pendleton, and lately carrying on business at 403, Liverpool Road, Patricroft.—Receiving order made January 10th on debtor's own petition.

R. H. Olney (Radio Services), wireless dealer, 17, Marlowes, Hemel Hempstead.—Public examination, February 7th, at the Court House, St. Albans.

T. C. Taylor, electrical contractor, 20, Queen Street, Blackpool.—Discharge suspended for six months until June 20th, 1940.

A. W. Sadler, radio engineer and dealer.—115, Osmaston Road, Derby.—Supplemental dividend of 1½d. in the £, payable at 22, Regent Street, Park Row, Nottingham.

L. Green (Green's Wireless Stores), wireless dealer, 70, Whitley Court Road, Quinton, Birmingham, lately trading at 94-96, Hurst Street, Birmingham.—Receiving order made January 15th on a creditor's petition. First meeting January 31st at 37, Temple Street, Birmingham. Public examination February 7th at the Court House, Birmingham.

E. C. Johnson (Edstan Electric), electrical contractor, 20, Market Street, Hanley, Stoke-on-Trent, and 40, London Road, Newcastle-under-Lyme.—Receiving order made January 18th on debtor's own petition.

Reports and Dividends

The Metropolitan Electric Supply Co., Ltd., held an extraordinary meeting on Monday last at which a resolution was passed authorising an increase of the capital to £4,000,000 by the creation of 500,000 4½ per cent. cumulative preference shares of £1 each, having the same rights as the 4½ per cent. preference shares. The shares when fully paid will be converted into stock. The company has placed privately £190,000 of 3 per cent. debenture stock.

International Combustion, Ltd., reports that the total earnings of the company and its subsidiaries for the year ended September 30th were £303,500, as compared with £236,334 for 1937-38. Directors' fees require £4,500, the preference dividend £9,000 and taxes £135,000, leaving a balance of £155,000 (against £167,933). The ordinary dividend for the year is maintained at 32½ per cent. by the final payment of 12½ per cent. and a cash bonus of 12½ per cent. Reserve receives £50,000 and the balance carried forward is £12,209 (against £21,510 brought in).

The Rheostatic Co., Ltd., reports a trading profit for the year ended September 30th of £36,695, as compared with £21,703 in the preceding year, plus miscellaneous income of £101. The net profit is £19,015 (against £11,346). A final ordinary dividend of 12 per cent. is paid, making 16 per cent. for the year (against 8 per cent.), tax reserve receives £3,000, investment reserve £2,000, and general reserve £2,000. The balance carried forward is £3,929 (against £1,579 brought in).

The Anglo-American Telegraph Co. is paying a first and final dividend of 1½ per cent. on the deferred shares (same).

Bennis Combustion, Ltd., is maintaining its interim dividend at 5 per cent.

R. B. Pullin & Co. Ltd., report a trading profit for the year to October 31st of £67,494, as compared with £46,497 in the preceding year, and a net profit, before tax, of £62,496 (against £42,360). Income tax requires £14,973, N.D.C. £1,293, and E.P.T. £13,000. The final dividend is 20 per cent., maintaining the distribution for the year at 25 per cent. (dividend paid on larger capital), reserve receives £10,000, and £4,196 is carried forward (against £5,966 brought in).

STOCKS AND SHARES

TUESDAY EVENING.

THE outstanding feature of the Stock Exchange markets at the present time is the strength shown by British Government and many other gilt-edged securities. On the Government's offer to convert the outstanding 4½ per cent. Conversion Loan into a new 2 per cent. stock at 100, investment was quick to appreciate this evidence of the Treasury's determination to continue the cheap money policy that is saving the country, in interest, millions of pounds a year. Prices of War Loan and similar securities have risen with a swing. In sympathy, other safety-first stocks and shares have followed suit.

Investors are eager to discover security from which they can expect to get 4½ to 5 per cent. There is little doubt as to prompt subscription for the Metropolitan Electric Supply Company's new 4½ per cent. preference shares of £1 each when these are offered. Cable and Wireless stocks have risen sharply on investment demand. Further strong features are to be found in the Home Railway market.

Gilt-edged Buoyancy

The fact and the terms of the Treasury's scheme for dealing with the £350 millions Conversion 4½ per cent. loan will interest the general investing public chiefly by implication. The bulk of the loan in question has for some time been in the hands of the money institutions. The stock which is offered as an alternative—a 3-5 year issue carrying 2 per cent. interest—is evidently designed to appeal mainly to those holders. All the same, the mere fact that even a short-term loan is offered at so low a rate of interest, has caused the prospects for the Treasury's chief borrowing programme to be viewed in a new perspective. If, it is argued, the Government can borrow money on a short-term basis at 2 per cent., there should be little difficulty in raising 15-20 year loans at, say, 3 per cent. or less; while long-term or irredeemable issues bearing 3½ per cent. interest come well within the picture. Hence there is an immediate adjustment of prices, all along the gilt-edged list, to a lower yield basis; and hence also the belief in the possibility, barring accidents, of a further advance, in which, for instance, the price of 3½ per cent. War Loan—a stock with no fixed date for redemption—might well close up the gap of 1½ points or so between the present quotation and par before the first popular loans appear in the market. London Passenger Transport, Central Electricity, London Electric Transport and similar stocks show rises ranging from 1 to 3 in this week's list.

Public Board Issues

Stocks of the Central Electricity and London Transport Boards have been for some time past difficult to buy; and the search for safe investments giving a return slightly better than the dwindling yields on Government issues, has emphasised the shortage of stock. Central Electricity Board 4½ per cent. stock, redeemable 1951/73, is quoted officially at 104; but 106 is the price at which a small amount of stock is in the market, giving a running yield of four guineas per cent. or 3¾ per cent. allowing for the loss of 6 points on redemption at the earliest date. The Board's 3¼ per cent. issue, dated 1974/94, presumably with more than 50 years to run before repayment, is offered in a small way at 85, at which the yield is £3 16s. per cent., with a florin per cent. more allowing for redemption.

By way of illustration of the appetite now prevailing for gilt-edged stock, it may be mentioned that the fairly large block of North Metropolitan Power 3½ per cent. debenture stock, to which attention was drawn here last week, as being on offer at 91¾, free of stamp, has now been taken. There is no more cheap stock to be obtained. Investment which appreciated the security will not be surprised to know that buyers in the market are offering 92¼, without their being able to attract the stock for which they themselves have purchasers at a higher figure.

Preference Shares on Offer

A selection from the electricity supply market's attenuated stock of available preference shares may be of interest in the circumstances:

Preference Shares	Div. %	Price	Yield % £ s. d.
Bournemouth & Poole	4½	22/3	4 0 0
City of London 2nd	8	34/-	4 14 0
Elec. Distbn. of Yorks	6	27/6	4 7 3
Elec. Fin. & Securities	7	27/-	5 3 6
London Assoc. Elec.	4½	20/6	4 7 9
South Met. Elec. 3rd	4	18/9	4 5 3

Half-yearly dividends are due next month on the Bournemouth and Yorkshire companies' shares; and in March in the case of the City of London and South Metropolitan issues.

Home Railway Dividends

Negotiations between the Home Railway companies and the Government over the wartime compensation terms are taking what most people consider an unconscionable time in reaching their conclusion. Judging, however, from the way in which the market has lately raised fresh steam, the terms are expected to be of a character well worth waiting for. In accordance with this optimism, many of the speculative issues have added fresh gains to the previous advances, Southern preferred, at 68, and 5 per cent. preference, at 97½, being 3 and 4½ points, respectively, to the good. Senior stocks received a strong fillip from the buoyancy of the gilt-edged market.

The problem of dividend decisions, however, is becoming acute. On Wednesday last week the Minister of Transport gave it as his opinion that the delay in the negotiations was no reason for a postponement of Great Western dividends. The company concerned has been quick to rejoin that dividends are paid on the authority of resolutions passed at the annual meeting, which must be held in February, and that the accounts must have been certified by the auditors. As matters stand, a balance cannot be struck except by taking some hypothetical figure for revenue in that part of the year in which control was in Government hands. A short delay in the payment of dividends would be preferable, it is held, to such a course.

Electricity Supply Shares

It is safe to assume that the market in electricity supply ordinary shares would be among the first to notice a shift in the investment wind towards the quarter benefiting equities The approach of the dividend season in that section sometimes has the effect of stirring fresh interest and activity. The present occasion appears, on the contrary, to be making for restraint, leaving a volume of business scarcely sufficient to test the level of prices. Edmundsons' shares obtain a large proportion of such dealing as passes. At the buying price of 23s. 9d., the yield is just over 5 per cent., assuming that the final dividend due in June again brings the distribution for the year to 6 per cent. That assumption is regarded as among the most assured of the year's events in the market. It is based to some extent on the figures showing that the output of the group in the first four months of the war was 14 per cent. higher than for the corresponding months of 1938. In the absence of official figures, the monthly returns of the widely spread Edmundsons' group are taken as a rough index for the industry as a whole, and lead, therefore, to encouraging deductions as to the net effect of wartime conditions on the use of electrical energy. London Associated Electrics have advanced to 20s., Clyde Valley ordinary are 1/6 up, at 34s. 6d. North Eastern, Lancashire and Llanelly shares are all better. In the overseas group, Victoria Falls ordinary at 71s. 3d. have gained 1/6.

Brakes and Signals

Westinghouse Brake and Signal shares have been coming under pressure with the approach of the dividend date. From 42s. 6d. at the beginning of the year, the price has declined to 38s. 9d. The explanation offered refers to the company's important connections on the Continent; the large contract with the Polish railways is said to have been due for completion this year, and other contracts are believed to be held with Baltic countries. On the other hand, business at home is considered likely to be very active. The facts of the matter will be better known when the report, due in a few weeks' time, is out. Consolidated Signal shares, now 60s., have been sympathetically dull.

Thomas Tilling.

One of the most interesting of the New Year reports and accounts will be that from Thomas Tilling, Ltd. In the four years 1935-1938 inclusive, the distributions were at the rate of 10 per cent. per annum. As the subsidiary, Tilling and British Automobile, recently reduced its dividend from 9 per cent. to 8 per cent., both free of tax, some doubt has arisen as to whether Thomas Tilling may not follow in the same direction. The market view is, however, that Tilling's profits are likely to be sufficient to warrant repetition of the 10 per cent. rate.

There are 5,000 ordinary shares on offer in the market at 37s. 9d., at which the return on the money, if the company maintains its 10 per cent. dividend, will be £5 6s. 6d. per cent. Dividend payments are due in March and September. The interim last September was 5 per cent., and the declaration of the final is due very shortly.

Repercussions

As already noted, one result of the cut in the yields on gilt-edged stocks has been the intensification of the demand for securities round the edge of the gilt-edged section. Among the prior-charge issues of the electricity and railway companies, this development is particularly marked. Whether the ripples will spread more widely remains to be seen. Already the desire for better yields is showing itself to some extent in inquiry for preference shares of what might be called the second grade. Up to now, however, there is little sign that the same need has achieved urgency enough to encourage a sally into the more speculative field of equities.

Yet many people would feel no surprise at a development in that direction; and most admit that the attraction of yields of 5 per cent. upwards on the safest of ordinary shares becomes automatically enhanced by the difficulty of employing money at more than 4 per cent. in the safety-first area. For the present, however, the industrial markets can detect little evidence of the stimulation which a trend on those lines would bring. Business in that section has, indeed, declined in the last week or two. Renewed buying of Cable and Wireless issues, on the other hand, may have been prompted by some such reasoning. Both the ordinary at 60½ and the preference at 98½ are quoted higher than at any time last year; the former stock rose 4 points within as many days.

ELECTRICAL COMPANIES' SHARES

Prices, Dividends and Yields

Company	1939 High-est	1939 Low-est	Dividend Pre-vious	Dividend Last	Price Jan. 23	Rise or Fall	Yield £ s. d. p.c.
Home Electricity Companies							
Bournemouth and Poole	68/3	56/–	15	15	57/6	—	5 4 4
British Power and Light	30/9	21/–	7	7	26/–	—	5 7 8
City of London	33/9	22/–	7½	7½	26/6	—	5 13 2
Clyde Valley	38/6	26/9	8	8	34/6	+⅛	4 12 9
County of London	46/9	28/–	10½	10½	35/9	+9d.	6 0 0
Edmundson's:							
7% Pref.	31/6	27/6	7	7	28/–	+6d.	5 0 0
Ord.	27/9	18/–	9	6	23/6	+1/–	5 2 2
Elec. Dis. Yorkshire	41/6	32/–	9	9	35/9	—	5 0 5
Elec. Fin. and Securities	48/3	39/–	12½	12½	40/–	—	6 5 0
Elec. Supply Corporation	51/9	40/–	12	12	41/3	—	5 16 0
Isle of Thanet	20/–	15/–	4	4	15/–	—	5 6 8
Lancs Light and Power	34/6	25/–	7½	7½	30/9	+9d.	4 17 7
Llanelly Elec.	22/6	16/6	5½	5½	20/–	+1/–	5 10 0
Lond. Assoc. Electric	30/–	18/–	7	7	20/–	+6d.	7 0 0
London Electric	34/3	20/–	7	7	26/3	—	5 6 8
London Power Deb. Red.	106½	97	5	5	104½	+1	4 15 6
Metropolitan	51/–	32/6	12	12	37/–	—	6 9 9
Midland Counties	39/6	30/–	8	8	33/9	—	4 14 9
Mid. Elec. Power	41/9	33/6	8	9	36/3	—	4 19 4
Newcastle Elec.	28/9	25/–	7	7	26/3	—	5 6 8
North Eastern Electric:							
Ordinary	32/3	23/6	7	7	28/–	+1/–	5 0 0
7% Pref.	32/6	26/–	7	7	30/6	+6d.	4 11 10
Northampton	48/–	41/–	10	10	42/6	—	4 15 0
Notting Hill 6% Pref. (£10)	13½	10½	6	6	9½	—	—
Northmet Power:							
Ordinary	46/6	30/6	10	10	36/3	—	5 10 1
6% Pref.	29/–	23/6	6	6	27/–	—	4 9 0
Richmond Elec.	29/–	21/6	7	7	23/9	—	5 18 0
Scottish Power	38/9	27/6	8	8	32/6	—	4 18 6
Southern Areas	22/9	17/–	5	5	18/–	—	5 11 1
South London	30/9	22/–	7	7	22/–	—	6 7 3
West Devon	23/3	18/–	5	5	18/9	—	5 6 8
West Glos.	21/3	15/–	2	2½	16/3	—	3 1 6
Yorkshire Elec.	38/6	27/9	8	8	33/9	—	4 14 10
Overseas Electricity Companies							
Atlas Elec.	4/3	1/6	Nil	Nil	2/9	—	—
Calcutta Elec.	39/–	25/–	10*	10*	31/6	+6d.	—
Cawnpore Elec.	34/6	27/3	10	10	28/9	—	—
East African Power	26/3	20/–	7	7	23/6	—	5 19 2
Jerusalem Elec.	24/6	21/–	7	7	21/6	—	6 10 4
Kalgoorlie (10/–)	10/6	9/–	7½	7	10/6	—	6 13 4
Madras	31/–	21/3	8*	8*	22/–	—	—
Montreal Power	35½	30	1½	1½	34	—	—
Palestine Elec. "A"	27/3	19/6	7½*	5*	22/6	—	4 9 0
Perak Hydro-electric	19/6	12/6	6	2½	19/6	—	2 11 4
Shawinigan Power	25	20	85cts.	83cts.	25	–½	—
Tokyo Elec 6%	63	33	6	6	65½	—	9 0 6
Victoria Falls Power	73/9	60/–	12½	15	71/3	+⅛	4 4 3
Whitehall Investments Pref.	19/6	10/–	7½	7½	13/–	–1/–	11 10 10
Public Boards							
Central Electricity:							
1950–70	112	103	5	5	109	+1½	4 11 4
1955–75	115½	104½	5	5	110	+1	4 11 0
1961–78	106½	101	4½	4½	104	+1	4 6 7
1963–98	95½	84	3½	3½	92	+1	3 16 1
London Elec. Trans. Gtd.	88½	83	2½	2½	91	+2	2 15 0
London & Home Counties 1955–75	107½	105	4½	4½	106½	—	4 4 6
Lond. Passenger Transport:							
A	114½	103	4½	4½	107½	+2	4 3 9
B	117½	102	5	5	107½	+3	4 13 0
C	83½	64½	4	1½	65	—	2 6 2
West Midland Joint Elec., 1948–68	112½	104½	5	5	106	—	4 14 4
Telegraph and Telephone							
American Tel. & Tel.	210	159	9	9	209½	—	4 6 8
Anglo-Am. Tel.:							
Pref.	101½	82	6	6	94½xd.	+1	6 7 0
Def.	23⅜	17	1½	1½	21½xd.	+1½	6 19 6
Anglo-Portuguese	24/–	16/6	8	8	20/–	—	8 0 0
Cable & Wireless:							
5½% Pref.	97	75	4⅞	5½	98½	+2	5 11 8
Ord.	57⅛	35	4	4	60½	+4	6 12 4
Income	100	85½	—	—	95½	+2	4 3 7
Canadian Marconi $1	6/–	3/9	—	Nil	5/–	—	—
Globe Tel. & Tel.:							
Ord.	32/3	22/6	7½*	7½*	27/6	—	5 9 1
Pref.	26/9	20/–	6	6	25/–	—	4 16 0
Great Northern Tel. (£10)	38	18	20	20	20½	—	9 15 2
Inter. Tel. & Tel.	10½	5	Nil	Nil	5½	–¼	—
Marconi-Marine	30/–	23/–	7½	10	27/6	—	7 5 6
Oriental Telephone Ord.	2½	42/6	12*	12*	2⅜	—	6 1 0
Radio Corpn.	8¼	5¾	8	6	7¼	—	—
Telephone Props.	14/–	12/9	5	6	13/9	—	8 14 6
Telephone Rentals (5/–)	10/–	6/3	10	10	8/3	—	6 1 3
Western Union	40½	19½	2⅜	—	32½	—	—
Traction and Transport							
Anglo-Arg. Trams:							
First Pref. (£5)	7/6	3/6	Nil	Nil	4/–	–1/–	—
4% Inc.	16	5	Nil	Nil	9	—	—
British Electric Traction:							
Def. Ord.	950	500	5	5	650	—	—
Pref. Ord.	164	115	8	8	155	—	5 3 4
Bristol Trams	52/6	35/–	8	10	42/6	—	4 14 1
Brazil Traction	13	6½	$1	50c.	9¾	—	—
Calcutta Trams	25/6	20/9	8	8	23/–	—	6 19 2
Cape Elec. Trams	18/–	16/9	5	5	17/–	—	5 17 8
Lancs Transport	37/9	27/6	10	10	29/–	–1/–	6 18 0
Mexican Light:							
1st Bonds	35	20	5	5	35	—	—
Rio 5% Bonds	82	47	5	5	78	—	6 5 0
Southern Rly.:							
5% Prefd.	75½	48	5	5	68	+3	7 7 1
5% Pref.	99½	79	5	5	97½	+4½	5 2 6
T. Tilling	2½	32/6	10	10	37/6	–9d.	5 4 7
Tilling & B.A.	54/6	43/9	9*	8*	45/–	—	3 11 1
West Riding	37/9	30/–	10	10	28/9	—	
Equipment and Manufacturing							
Aron Electricity Ord.	32/3	22/6	15	15	22/6	—	—
Assoc. Elec.:							
Ord.	45/3	30/–	10	10	38/3	—	5 4
Pref.	36/6	30/–	8	8	32/6	—	4 18
Automatic Telephone & El.	48/9	37/–	10	12½	42/6	—	5 17
Babcock & Wilcox	48/–	37/–	10	12½	43/–	+6d.	5 16 4
British Aluminium Ord.	61/3	48/–	12½	12½	50/–	—	5 0 0
British Insulated Ord.	88/–	70/3	20	20	78/9	—	5 0 0
British Thermostat (5/–)	16/–	11/6	18½	18½	12/6	—	7 8 0
British Vacuum Cleaner (5/-)	22/6	8/–	40	12½	10/–	—	6 5 0
Brush Ord.	5/9	2/6	Nil	Nil	4/–	—	—
Callender's	92/–	50/–	20	15	60/–	—	5 0 0
Chloride Elec. Storage	82/–	62/–	20	15	3½	—	4 5 9
Consolidated Signal	96/–	60/–	36½	36½	60/–	—	12 3 4
Crabtree (10/–)	25/6	16/6	17½	17½	21/3	—	8 4 9
Crompton Parkinson: Ord. (5/-)	21/–	12/6	15	29	17/6	—	5 14 3
E. K. Cole (5/–)	9/–	2/6	10	Nil	4/6	—	—
Elec. & Musical Industries (10/–)	14/9	6/6	5	Nil	8/9	+6d.	—
Electric Construction	40/6	28/–	12½	13½	33/9	—	8 0 0
Enfield Cable Ord.	58/–	37/6	25	16½	47/6	—	6 16 10
Electrical Switchgear (10/–)	27/–	23/–	16	10	21/3	—	4 14 3
English Electric	36/6	25/–	10	10	30/–	—	6 13 4
Ensign Lamps (5/–)	16/9	13/9	25	25	15/–	—	8 6 8
Ericsson Tel. (5/–)	43/–	32/3	25*	25*	35/–	—	3 11 5
Ever Ready (5/–)	26/6	16/9	35	30	26/6	—	5 13 2
Falk Stadelmann	27/–	18/–	10	6	18/9	—	6 13 4
Ferranti Pref.	25/6	21/–	7	7	21/3	—	6 11 9
G.E.C.:							
Pref.	32/9	25/–	6½	6½	28/9	—	4 10 6
Ord.	82/–	61/–	17½	20	75/–	—	5 4 4
Greenwood & Batley	29/–	20/–	7	15	22/6	—	13 6 8
Hall Telephone (10/–)	22/3	7/–	15	15	18/9	—	8 0 0
Henley's (5/–)	21/–	13/9	20	20	18/9	—	5 16 8
4½% Pref.	23/–	18/–	4½	4½	18/9	—	4 16 0
Hopkinsons	46/9	37/–	12½	15	43/9	+⅛	6 17 0
India-Rubber Pref.	22/–	17/9	5½	5½	20/–	—	5 10 0
Intl. Combustion	121/3	97/–	32½	32½	5½	—	5 18 0
J. Lucas	61/–	42/6	15	15	55/–	—	5 9 1
Johnson & Phillips	42/6	32/–	12½	12½	42/6	—	5 17 8
Lancashire Dynamo	72/–	50/–	25	25	57/6	—	8 14 0
Laurence Scott (5/–)	12/–	8/6	15	15	9/6	—	7 18 4
London Elec. Wire	31/6	25/–	12	7½	26/3	—	5 14 4
Mather & Platt	50/3	37/6	13½	13½	45/–	+6d.	6 0 0
Metropolitan Elec. Cable Pf.	21/3	21/–	5½	5½	21/3	—	5 3 0
Murex	85/9	63/9	20	20	78/9	–⅛	5 1 6
Pye Deferred (5/–)	11/6	7/–	25	25	7/6	—	16 13 4
Revo (10/–)	35/6	22/–	17½	17½	21/3	—	8 4 9
Reyrolle	61/–	52/–	12½	12½	60/–	—	4 3 4
Siemens Ord.	26/9	17/–	7½	7½	20/–	—	7 10 0
Strand Elec. (5/–)	5/6	1/3	10	4	2/–	—	8 0 0
S. Smith (1/–)	9/6	5/6	37½	50	7/6	—	6 13 4
Switchgear & Cowans (5/–)	15/–	9/6	20	20	11/3	—	8 18 0
Telegraph Condenser (10/–)	7/6	5/–	5	—	7/6	—	—
Telegraph Construction	2½	27/6	10	10	32/6	—	6 3 1
Telephone Mfg. (5/–)	10/–	7/–	9	9	8/3	—	5 9 1
Tube Investments	91/6	68/–	23¾	23¾	90/–	+⅛	5 5 6
Vactric (5/–)	4/3	2/–	4	Nil	2/6	—	—
Vickers (10/–)	24/6	14/6	10	10	18/–	+6d.	5 11 1
Ward & Goldstone (5/–)	22/6	19/6	20	20	19/9	—	5 1 3
Westinghouse Brake	54/9	38/–	17½	17½	38/9	–⅛	8 0 9
Walsall Conduits (4/–)	31/9	21/3	55	55	25/–	—	8 16 0
West, Allen (5/–)	7/6	5/–	7½	10	5/9	—	8 14 0

* Dividends are paid free of Income Tax.

CONTRACT INFORMATION

Particulars of work for which tenders are invited, contracts placed, and building schemes promising work for electrical contractors and traders

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses. Further details of items marked with an asterisk can be obtained from the Department of Overseas Trade (Inquiry Room), Great George Street, London, S.W.1.

Australia. — MELBOURNE. — February 13th. State Electricity Commission of Victoria. Triple-braided copper aerial cable. (T. 15259/40.)*

April 2nd. Cable for three-phase 6.6-kV system. (T. 15010/40.)*

BRISBANE.—February 28th. City Electric Light Co., Ltd. Condenser tubes. (T. 15369/40.)*

Birkenhead.—February 13th. Electricity Department. Electric lamps for one year. (See this issue.)

Birmingham.—February 9th. Electric Supply Department. Three electrically driven pumps. (January 12th.)

Cardiff.—February 5th. Electricity Department. E.h.v. sub-station switchgear and e.h.v. and l.v. paper insulated cables for one year. (January 12th.)

Gellygaer. — February 16th. U.D.C. Electrical apparatus and materials for one year. (January 19th.)

Heston and Isleworth.—February 12th. Electricity Department. Sheet-steel housing and e.h.v. truck type switch. (See this issue.)

Iran.—TEHRAN.—March 1st. Ministry of Industry and Mines. Machinery for a cane sugar factory. (T. 23403/39.)*

Kettering.—February 5th. Electricity Department. Transformers. (January 19th.)

London.—BATTERSEA.—February 14th. Electricity Department. Electrical materials for one year from April 1st. (January 5th.)

KENSINGTON.—February 2nd. Borough Council. Electrical fittings (a) cables, flexibles, &c., and (b) conduits, fittings and accessories. F. Webster, town clerk, Town Hall, W.8.

Manchester.—February 1st. Electricity Committee. One 20-kW mercury-arc rectifier equipment. (January 19th.)

Newcastle-on-Tyne. — City Council. Maintenance and repair work on the various housing estates, including electric lighting repairs. Plans by R. G. Roberts, city architect, 18, Cloth Market.

New Zealand. — WELLINGTON.—Public Works Department. February 13th. Three single-phase transformer units. (T. 28146/39.)* Two 2,250-kVA three-phase boosting transformers. (T. 28144/39.)* Remote control equipment. (T. 28791/39.)*

February 20th. Seven single-phase transformer units. (T. 28148/39.)* Four single-phase transformer units. (T. 28147/39.)*

February 27th. 22-kV switchgear. (T. 28858/39.)* 11-kV switchgear. T. 28789/39.)*

February 13th. Cable and cable boxes. (T. 15292/40.)*

March 5th. Cables. (T. 30431/39.)*

March 12th. 110-kV outdoor switchgear and steelwork. (T. 28145/39.)* Six 66-kV air-break switches. (T. 15486/40.)*

March 26th. Four single-phase transformer units. (T. 28143/39.)*

March 19th. Switchgear and steelwork. (T. 30384/39.)*

March 19th. 11-kV switchgear. (T. 15487/40.)*

April 2nd. Switchgear and steelwork. (T. 30385/39.)*

Reigate.—January 27th. Town Council. Electrically driven pumping machinery at the Nag's Head ejector station. Borough surveyor, Town Hall (deposit £1 1s.).

Salford.—February 14th. Corporation. Stores. (See this issue.)

*

South Africa.—SALISBURY (S. RHODESIA).—April 15th. Municipality. Cables. (T. 30438/39.)*

February 5th. Insulators, stay wire and copper conductor. (T. 15120/40.)*

February 19th. L.v. and h.v. switchgear. (T.Y. 15306/40.)*

CAPE TOWN.—March 6th. Electricity Department. Two 500 kVA (or alternatively two 600 kVA) three-phase transformers and two 50 kVA transformers. (T. 15056/40.)*

JOHANNESBURG. — February 15th. Union Tenders and Supplies Board. Cable trailer. (T. 15475/40.)*

February 15th. Public Works Department. Low voltage switchgear, transformer and cable. (T. 15502/40.)*

Stoke-on-Trent.—February 14th. Electrical Engineer's Department. Mains and cables, high-voltage truck type sub-station switchgear, transformers and meters for one year. (January 19th.)

Sutton and Cheam.—January 26th. Electric lighting in public shelters, and constant potential battery charger, for Corporation; N. H. Mitchell, borough engineer, High Street, Sutton, Surrey (deposit £2 2s.).

Uxbridge.—January 31st. U.D.C. Electric lamps for one year. E. E. T. Bolton, engineer, 263, High Street.

Orders Placed

Brighton.—Electricity Committee. Accepted. Supply and installation of equipment to line up with that which was installed to replace the board for works power switchboard destroyed by fire (£6,712).—Switchgear & Cowans.

Town Council. Accepted. Erection of a 50,000-kW turbo-generator set complete with ancillary apparatus at Southwick power station (£185,000).—Brush Electrical Engineering Co.

London.—WESTMINSTER.—Works Committee. Recommended. Fuses and connectors for 19 electric-horse motive units (£66).—Electricars.

METROPOLITAN WATER BOARD. Accepted. Trident electric boiler and tube cleaning machine for Hammersmith works (£85).—Liverpool Patents Co.

JOINT ELECTRICITY AUTHORITY. Accepted. E.h.v. switchgear for Twickenham sub-station (£1,005). — Yorkshire Switchgear & Engineering Co.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Ashton-under-Lyne. — Reconstruction of baths, including installation of two calorifiers; Matley, Brotherton and Mills, architects.

Billingham.—Alterations to the Black Horse Inn, for Vaux and Son; Kitching and Co., architects, 21, Albert Road, Middlesbrough.

Birmingham.—New building in Bath Street, for Birmingham Typographical Society, 110, John Bright Street; J. R. Deacon, contractor, Lombard Street, Lichfield.

Blandford.—Houses, Langton Road, for T.C.; L. Tait, borough engineer, Blandford.

Blaydon (Co. DURHAM).—Air-raid shelters; U.D.C. surveyor.

Brighton. — Flats, 26, Buckingham Place; W. T. Bradshaw.

Houses, Porthall Avenue; F. A. Fuller.

Flats, Clyde Road; Sundius Smith Trust.

Bristol.—Shop premises, Old Market Street, for T.C.; J. N. Meredith, city architect, Eagle House, Colston Avenue.

Cannock (STAFFS).—Offices in Station Road, Hednesford, for Britannic Assurance Co., Ltd., Broad Street Corner, Birmingham; Skelcher, Machin and Watson, architects, International Exchange, 156, Edmund Street, Birmingham, 3.

Castle Ward (NORTHUMBERLAND). — Hotel at the Newburn-Westerhope cross roads; Newcastle Breweries, Ltd., Haymarket, Newcastle-on-Tyne.

Chester. — Smithy extensions, New Crane Street; Crosville Motor Services, Ltd.

Croydon. — Completion of Davison's school (£6,973); Education Committee.

Extensions to fire station (£7,000); borough engineer.

Workshops, Merton Road; Vacuum Science Products, Ltd.

Darlington.—Houses, Woodside Drive, for T. W. Morris; J. E. Chilton, architect, Tubwell Row, Darlington.

Alterations to Maidendale Farm buildings, for the T.C. (£1,200); borough engineer.

Warehouse, Weir Street; Blackett and Son, Darlington.

Derby.—Welding building, Butterley Iron Works; Butterley Co., Ltd., Ripley.

Eston (NEAR MIDDLESBROUGH).—Heating and domestic hot water supply at R.C. school; T. Crawford, architect, 82, Borough Road, Middlesbrough.

Gateshead.—Hotel, Split Crow Road, for Arrol and Son, West Blandford Street, Newcastle-on-Tyne.

Licensed premises, Chow Dene Farm, for Newcastle Breweries, Ltd., Haymarket, Newcastle-on-Tyne.

Alterations to Barclay's Bank, West Street; Arthur and Kirkup, architects, 13, Swinburne Street, Gateshead.

Glasgow.—Skating rink, Kelvin Hall; city engineer.

Seven clinics (£40,000); city engineer.

Disinfecting station, Ruchill (£3,500); city engineer.

Halesowen.—Additions and alterations,

(Continued on next page.)

FORTHCOMING EVENTS

Institution of Electrical Engineers.—Monday, January 29th. Institution, London. 6 p.m. Informal meeting. Discussion on "Load Building in War-time," opened by Mr. F. W. Purse.

North Midland Centre.—Saturday, January 27th. Hotel Metropole, Leeds. 2 p.m. "The Applications and Limitations of the Inverse-Time Overload Relay to the Protection of an 11 kV Network," by Messrs. J. W. Gallop and R. H. Bousfield.

West Wales (Swansea) Sub-Centre.—Thursday, February 1st. Technical College, Swansea. 6.30 p.m. Chairman's address by Mr. A. Rees.

Meter and Instrument Section.—Friday, February 2nd. Institution, London. 6 p.m. "The Maintenance of Relays and Associated Equipment," by J. R. Brookman (to be presented by Mr. F. J. Lane).

Royal Institution.—Friday, January 26th. Albemarle Street, London. 5 p.m. "Long Distance Broadcasting," by Sir Noel Ashbridge.

Junior Institution of Engineers.—Friday, January 26th. 39, Victoria Street, S.W.1. 6.30 p.m. Informal meeting. "The Advantages Accruing from Forced Circulation Boilers" (with special reference to the Lamont type), by Captain R. E. Trevithick.

Electrical Association for Women.—Wednesday, January 31st. 20, Regent Street, S.W.1. 2 p.m. Reunion party.

Institution of Mechanical Engineers (*North-Western Branch*). — Saturday, February 3rd. Central Library, Manchester. 2.30 p.m. "A Review of Forty Years' Development in Mechanical Engineering Plant for Power Stations," by Sir Leonard Pearce.

Tenter Drive, for Cottage Hospital Committee; secretary.
Workshop extension, Whitehall Road; A. J. Emery & Son.

Hertfordshire.—Senior school, site adjoining the Priory, Royston, for E.C.; Education Department, Castle Street, Hertford.

Heywood.—Houses (204), Gooden Farm site, for T.C.; borough engineer.

Jarrow.—Two cleansing stations for Durham C.C.; W. J. Merrett, county architect, 43, Old Elvet, Durham.
Erection of baths and gymnasium, for the T.C. (£28,000); borough engineer.
Surface shelters at St. Bede's Junior School, for the E.C. (£1,200); borough engineer.

Keighley.—Houses for D. O'Connell, Moorview Estate, Long Lee.

Kent.—Four clinics (£18,000); county architect, Maidstone.

Leamington Spa.—Erection of office block and a water softener plant house in Tachbrook Road, for Lockheed Hydraulic Brake Co., Ltd., Tachbrook Road; Stowe and Co., Ltd., contractors, 111, Regent Street, Leamington Spa.

Leigh (LANCS). — Houses, Charles Street, for H. Whittaker, 299, Charles Street.

Lindsey.—Police buildings and courthouse, Scunthorpe, for Standing Joint Committee; county architect, County Offices, Newland, Lincoln.

Liverpool.—Extension to factory and garage, Derby Place, for Paton Calvert & Co., Ltd., Binns Road, Old Swan.
Factory buildings, Flint Street and Jordan Street, for F. H. Porter, Ltd., 5, Shaws Alley.
Hospital, Rose Brow and Gateacre Brow, Little Crosby, for the Society of the Sisters of Charity of St. Vincent de Paul, Little Crosby, Blundellsands; Wm. Ellis, architect, Union Bank Buildings, Hardshaw Street, St. Helens.

London.—FULHAM. — Air-raid shelters on the Council's housing estates (£18,528) and two public shelters at Heckfield Place (£3,200); borough surveyor.

Ludlow.—Renovation of Council Chamber, for T.C.; borough surveyor.

Lymm.—Warehouse, Warrington Lane; Agden Salt Works, Ltd.

Manchester.—Erection of Charlestown Hotel, Charlestown Road and Belthorn Road, Moston, for Peter Walker and Son (Warrington and Burton), Ltd., Dalham Brewery, Warrington; J. & N. Dickinson (1922), Ltd., general contractors, 37, St. George's Road, Bolton.

Middlesex.—Completion of extensions to Stationers' Company's School, Hornsey (£27,000); county architect.
Completion of Enfield Grammar School (£32,000); county architect, Great George Street, London, S.W.1.

Middleton.—Works extension, for the Belstaff Manufacturing Co., Ltd., Tonge Mills, Oldham Road.

Middlesbrough. — A.R.P. accommodation at schools; Cecil Gorman, borough engineer.

Alterations to Hemlington Hospital to improve staff accommodation; borough engineer.

Morley.—Additions, 230-248, Wakefield Road, Drighlington; Appleyard (Textiles), Ltd.
Alterations to warehouse and offices, Peel Street Mills; W. & E. Jackson (Morley), Ltd.

Morpeth.—Inn on the Stobhill Gates estate; J. Jobling and Co., owners, 40, Westgate Road, Newcastle-on-Tyne.

Newcastle-on-Tyne.—Air-raid shelter at the Smallpox Hospital, for the City Council; city architect, 18, Cloth Market, Newcastle.
Premises in connection with clearance plans; city architect, 18, Cloth Market, Newcastle-on-Tyne.

Norwich.—Additions and alterations, Bull Close School, for conversion to central kitchen, for T.C.; city architect, City Hall.

Pembroke.—Adaptation of premises, Pembroke Market House, as school clinic, for E.C.; borough engineer, Municipal Offices, Bush Street, Pembroke Dock.

Pembrokeshire.—Erection of factory at Merlins Bridge, Haverfordwest, for Dried Milk Products, Ltd., Dominion Buildings, 2, South Place, London, E.C.2; Rees Davies, contractors, Catherine Street, Carmarthen.

Portland.—Shop premises, Fortuneswell; Mr. Hounsell.

Preston.—Alterations and additions to the Sharoe Green Hospital and Chestnuts Sanatorium; R. Williams, borough engineer and surveyor, Town Hall.

Ramsbottom. — Extensions, St. Wilfred's Church, Summerseats; J. Schofield, architect, Redbrook, Holcombe Brook.

Rawtenstall.—Shelters (22) and five wardens' posts; H. Isherwood, town clerk, Town Hall.

Redditch.—Houses (50), Studley Road; U.D.C. surveyor.

Runcorn.—Baths, cubicles and heating chamber, Dutton Isolation Hospital, for R.D.C.; A. J. King, engineer, Castle Park, Frodsham, near Warrington.

Salford.—Extension to works in Gravel Lane, Greengate, for Greengate & Irwell Rubber Co., Ltd., Greengate Works, Salford.

Shropshire.—Junior school, Donnington, for E.C.; county architect, 5, Belmont, Shrewsbury.

Silksworth (Co. DURHAM).—Rebuilding of offices at Silksworth Colliery, following fire; Lambton Hetton and Joicey Collieries, Ltd., Cathedral Buildings, Newcastle-on-Tyne.

South Molton.—Fire brigade headquarters, site of Ebenezer Chapel, East Street, for R.D.C.; surveyor.

Southampton. — First-aid post at Borough Hospital, for T.C.; borough engineer, Civic Centre.

Southgate.—Erection of seven public shelters (340 persons), for B.C.; borough engineer, Southgate Town Hall, Palmers Green, N.13.

Southend-on-Sea. — Workshop block, London Road school site, for T.C.; borough engineer.

St. Albans (HERTS).—Structural alterations, etc., St. Albans Hospital (£6,450); J. T. Bushell, Ltd.

Stafford.—Completion of new maternity and child welfare centre, for Town Council; borough surveyor.

Stanley (Co. DURHAM).—Alterations to auxiliary fire station, for the U.D.C. (£963); J. R. Heslop, surveyor.

St. Ives.—Houses, Hilton, for R.D.C.; surveyor, Council Offices, St. Ives, Hunts.

Stockton-on-Tees.—Air-raid shelters for the Tiley Road Schools and alterations to Norton High Street Schools, for the E.C.; borough engineer.

Stirling.—Bus station, including offices and waiting rooms, for W. Alexander & Sons, omnibus proprietors, Camelon; Mr. McMain, of W. Alexander & Sons, Camelon, Stirlingshire.

Taunton. — Reconstruction, Victoria Inn, East Reach, and additions to Sun Inn, Canal Road, for Starkey, Knight and Ford, Ltd.
Additions to premises, Cheddon Road; F. C. Spear, Ltd.

Tendring.—Alterations, Skinners Arms, Station Road, Manningtree; Wells and Winch.

Torquay.—Crematorium, Hele, Newton Abbot, for T.C.; borough surveyor.

Tynemouth (NORTHUMBERLAND).—Electric light installations in school air-raid shelters; D. M. O'Herlihy, borough engineer, Town Hall, North Shields.

Valleyfield (FIFE).—Pithead baths, for Miners' Welfare Commission, Tufton Street, London, S.W.1.

Wakefield.—Conversion of buildings, York Street, to central ambulance depôt, for T.C.; borough engineer.
Headquarters, Brook Street, for Council of Social Service.

Wallington. — Fish restaurant, 14, Butter Hill; C. D. Leech.

Wallsend.—Air-raid shelters at schools for the E.C. (£7,000). Contractors: R. Alder Gofton and Son, Monkseaton; E. Leech, Newcastle-on-Tyne; T. Clements and Son, Jesmond, Newcastle-on-Tyne; J. H. James, Wallsend; E. Thompson, Grey Street, Newcastle-on-Tyne; and A. Weir, Howdon, Wallsend.

Wigan. — Business premises, Post Office Yard, Wallgate; Burtonwood Brewery Co., Ltd., Collins Green.

York.—New boiler house, workshops, etc., at North Riding Mental Hospital, Clifton, for Visiting Committee; Ward and Leckenby, architects, 9, Museum Street, York.

Australian Electrical News

OUR Australian correspondent reports that importers and wholesalers of electrical goods in the Commonwealth are faced with a number of difficulties, particularly late deliveries from overseas. However, trade in general is good and sales of the larger types of electrical merchandise, especially refrigeration equipment, are exceptionally good in New South Wales, where the policy of the Sydney County Council in offering refrigerators on no-deposit five-year terms has had outstanding results.

With the coming of summer weather sales of seasonal lines have improved but spending money in general is quiet. Prices in many cases have advanced, on some items as much as 15 per cent. The popularity of motorless refrigerators (heating element) is rapidly increasing, and almost all makes now carry a five-year guarantee.

According to a recent Tariff Board report, prices of wireless valves are too high, and the existing margin of protection for valves should be reduced rather than increased. Reasons given by the Board for refusing manufacturers' requests for prohibitive duties on wireless valves are: The prices of valves to consumers are too high, not only in Australia but in the United Kingdom and other countries, excluding the United States; the higher cost of valves to consumers because of Australian manufacture is already very heavy in proportion to the benefits derived; it is undesirable that the present control over the market exercised by the valve manufacturers should be strengthened by the exclusion of overseas valves; the great bulk of raw materials used by the Australian manufacturers is imported under departmental by-laws free of duty under British preferential tariff and 15 per cent. duty under the general tariff; the profits earned by at least one Australian valve manufacturer are excessive; the industry cannot be regarded as still in the developmental stage in view of the fact that valves have been produced in Australia for a number of years and local manufacturers are now supplying approximately two-thirds of the Commonwealth demand.

The South West National Power Commission (W.A.) recently took evidence in Bunbury regarding the Collie national supply scheme. The Mayor of Bunbury said that the scheme was a good one, but possibly 15 to 20 years ahead of its time. The engineer of the Bunbury power house said he would be nervous about dispensing with his present plant owing to the possibility of strikes at Collie. The representative of the Bridgetown Road Board stated that he would rather pay £2,000 into a national scheme than spend the money replacing the Board's obsolete plant. The representative of several sawmills considered that nothing could replace steam for the mills, owing to the waste material which was continually burnt as fuel. There was, he said, no prospect of the State sawmills using electric power in the south-west.